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ABSTRACT

This revised edition includes new material recommended by a panel of experts in the field of recreational planning. The following topics are covered: (1) the planning process; (2) indoor facilities; (3) outdoor facilities; (4) indoor and outdoor swimming pools; (5) encapsulated spaces and stadiums; (6) service areas; (7) recreation and park facilities; (8) planning for the handicapped; and (9) trends in facility planning. The book is illustrated with photographs and diagrams of the facilities under discussion. (JD)

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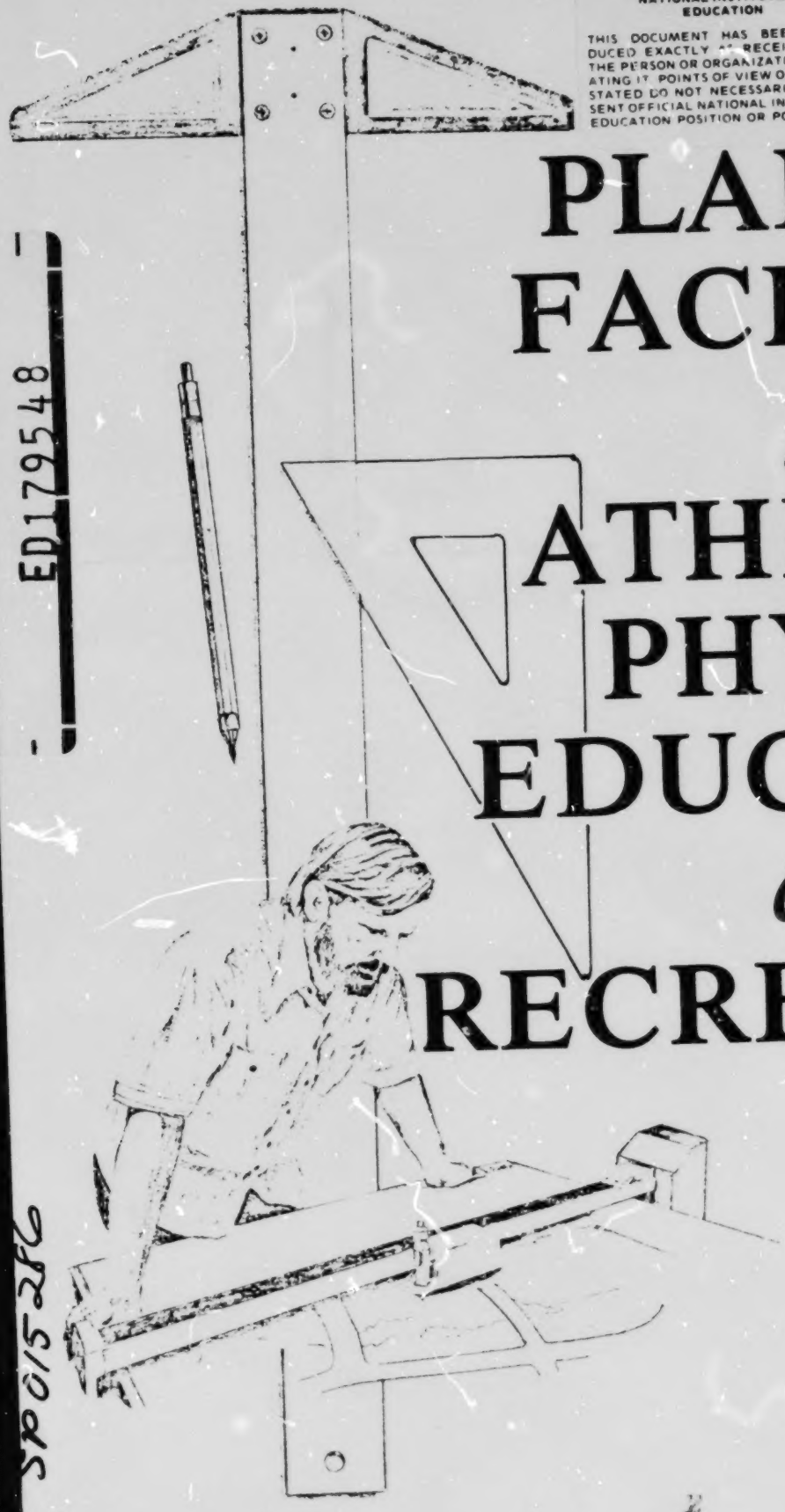

PLANNING FACILITIES *for* ATHLETICS, PHYSICAL EDUCATION *and* RECREATION

REVISED 1979

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North Palm Beach, Florida 33408

and

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FOREWORD

At a meeting of the Board of Directors of the American Alliance for Health, Physical Education and Recreation, held in Washington, D.C., in April, 1945, favorable action was taken on a proposal by Caswell M. Miles, AAHPER Vice-President for Recreation, that a grant of money be obtained to finance a national conference on facilities. Subsequently, a request for $10,000 to finance the first facilities workshop was placed before Theodore P. Bank, president of **The Athletic Institute.** At a later meeting of the Board of Directors of **The Athletic Institute,** the project was approved and the money appropriated to finance the first workshop.

Thirty-four years have elapsed since the printing of the first *Guide* which resulted from the first workshop, held at Jackson's Mill, West Virginia, in December, 1946. Since then there have been 13 printings of the *Guide.*

The second workshop was held May 5-12, 1956, at the Kellogg Center for Continuing Education, Michigan State University, East Lansing. The second workshop, like the first, was financed by **The Athletic Institute.** The 1956 edition of the *Guide,* which resulted from the second workshop, has been widely used in planning and constructing facilities.

The third workshop, which was financed jointly by the AAHPER and **The Athletic Institute,** was held January 15-24, 1965, at the Biddle Continuing Education Center, Indiana University, Bloomington. The 1965 edition of the *Guide,* which was prepared by the third workshop, has been well-received throughout the country.

During recent years, there have been many new developments in facility planning and construction. These have been due to a number of factors. The need for improving education, recreation and fitness opportunities for the youth of the nation has been highlighted by many groups. The fine work of the President's Council on Physical Fitness is one illustration of the growing national interest in health, physical education and recreation activities. Much of the research and attention devoted to facility planning and construction during the past 30 years has been due to the increased leisure time in our society and a growing realization that recreation and especially physical activity, is a fundamental human need essential to the well-being of all people.

At the 1965 facilities workshop, there was an expressed interest in the need for a *Guide* on college facilities. It was pointed out that the earlier *Guides* had been directed toward community and school use. Although some attention was given to basic college needs by those attending the 1965 workshop, the participants agreed that a college and university *Guide* should be prepared at at subsequent workshop. As a result, AAHPER and **The Athletic Institute** again agreed to finance such a project and the dates of April 29-May 8, 1967, were set for the fourth workshop.

The delegates for the 1967 workshop were carefully selected on the basis of their particular knowledge and contributions. Among those invited were a number of outstanding college and technical personnel engaged in planning and conducting programs of athletics, recreation, outdoor education, and physical and health education. In addition, invitations were extended to a number of specialists responsible for planning and constructing facilities for these programs. These specialists included city planners, architects, landscape architects, engineers and schoolhouse construction consultants.

Early in the planning, chairmen were selected for the various workshop committees. These committees were busily engaged in conducting research and gathering data before the workshop, which was again held at the Biddle Continuing Education Center at Indiana University.

Workshop participants approached the task of preparing the new *Guide* from the standpoint that adequate programs of athletics, recreation, outdoor education, and physical and health education can be provided only through co-operative planning directed toward the most economical and efficient use of the total resources. Every effort was made to incorporate the most recent advances in facility planning and construction. At the same time, an attempt was made to identify new needs and to anticipate future ones.

At the 1974 facilities committee meeting, there was an express concern that the *Guide* be changed to meet the needs of a new era in construction. Five committee members were assigned the task of restructuring the *Guide* in such a way that it would serve as a more practical tool for school administrators, physical education department heads, architects, planning consultants and all others who may either be interested in planning new areas and facilities or checking the adequacy of those already in use.

This, the 1979 edition of the *Guide,* includes new and timely material recommended by a panel of experts in the field. Some material, considered irrelevant or secondary in nature, has been deleted to provide sharper focus on those aspects of physical education and recreation considered by the editorial board to be more pertinent.

The Athletic Institute and AAHPERD Council on Facilities, Equipment, and Supplies initiated the 1979 revision of the Guide following a careful review of the 1974 edition. A blue ribbon Steering Committee was appointed and Edward Coates, Ohio State University, and Richard B. Flynn, University of Nebraska at Omaha, were selected as co-editors. Professionals well known for their experience in facility planning and construction were invited to assist in a complete rewrite. The Guide, therefore, does not represent any one person's or organization's viewpoint. It does represent the composite knowledge of many experts. The AAHPERD and **The Athletic Institute** are grateful to all who participated in the revision (see page iv).

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Professor Ken Penman and John Wiley & Sons, publishers, for permission to reprint diagram on *Planning Physical Education and Athletics in Schools.*

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A TABLE OF CONTENTS

Page

Chapter I: The Planning Process 2

Basic Considerations. Community Involvement and Interagency Cooperation. Planning for the Handicapped. Maintenance Considerations. Long Range Planning. Planning Stages. Survey and Evaluation of Existing Facilities. Stages of Team Approaches to Planning. Writing the Program. Role of the Program Specialist. Role of the Consultant. Selecting the Architect. Starting to Work. Follow Through. Planning Factors. Planning Units: Community and Schools. The Park-School Concept. Planning Units for Colleges and Universities.

Chapter II: Indoor Facilities 19

Site Selection. Traffic Circulation. Teaching Stations. Indoor Surface Materials. Sound Control and Acoustics. Electrical Systems and Service. Climate Control. Security. Planning for Specific Programs. Elementary School Indoor Activity Areas. Secondary School Indoor Activity Areas. Secondary School Gymnasium. College/University Indoor Activity Areas. College/University Facilities for Research. Specific Laboratory Facilities. Research and Testing Laboratories. Check List for Facility Planners Relating to General Indoor Facility Features.

Chapter III: Outdoor Facilities 54

Elementary and Secondary School Outdoor Facilities (Special Considerations). Sports and Athletic Facilities. College and University Planning. Design and Dimensions of Various Playfields.

Chapter IV: Indoor and Outdoor Swimming Pools 84

Planning Considerations. Design. The Program. Location of Specialized Areas. Recommended Features. Recirculation and Filtration Systems. Chemical Equipment. Pool Shell Equipment. Considerations Specific to Outdoor Pools. Checklist for Planners of Swimming Pools. The Pool as Part of a Recreation Complex. Spectator Seating. Sound Systems. Checklist for Planners of Swimming Pools.

Chapter V: Encapsulated Spaces and Stadiums 101

General Planning Considerations. Location. **Fieldhouses:** Systems Construction. Tensile Structures. Geodesic Dome. Air Structures. Advantages and Disadvantages. Conventional Design. Fieldhouse Floors. Lighting, Heating and Ventilation. Bleachers and Balconies. Service and Auxiliary Units. Storage Space. **Stadiums:** Seating Capacity. Design. Seating Arrangements. Lighting and Electrical Facilities. Communication Facilities. Developing space Beneath Stadium. Field Surface. Additional Accommodations for Public Events. Provisions for Future Expansion. **The Ice Arena:** Size. Refrigeration. Ice Hardness. Rink Floor. Dehumidification. Heating. Locker Rooms. Floor Covering. Lighting and Sound System. Checklist for Encapsulated Spaces.

Chapter VI: Service Areas 122

The Dressing Locker Room. Facilities for Lockers and Showers. Toilet and Lavatory. Lockers and Locker Boxes. Special Features of Elementary Locker Rooms. The Athletic Team Locker Room. Storage Rooms. Laundry. Training Rooms. Facilities for Faculty and Staff. Service Area Check Lists.

Chapter VII: Recreation and Park Facilities 145

Community Involvement. Planning Considerations for Metropolitan Areas. The Community Center. Check List for Indoor Recreation Facilities. Outdoor Community Areas and Facilities. Neighborhood Playground. Neighborhood Park. Community Parks and Playfields. City-Wide or District Park. County and Regional Recreational Areas. State and National Recreation Areas. Special Use Areas and Facilities. Areas for Outdoor Education/Recreation. Camps and Camping.

Chapter VIII: Planning for the Handicapped 191

Accessibility and Attitudes. Legislative Foundations, Design Guidelines. Modifications and Adaptations. Financial Considerations. Guidelines for Community Action.

Chapter IX: Trends in Facility Planning ... 199

Basic Trends. Effects of Legal Requirements and New Legislation. Curricular Trends. Economic, Environmental and Aesthetic Factors. Technological Advances and Equipment. Ideas for Planning Facilities.

A TABLE OF ILLUSTRATIONS

Chapter I

THE PLANNING PROCESS

Figure		Page
1	A Sample Planning Model for Physical Education Facilities Development	5
2	Facilities Survey and Evaluation Chart	7

Chapter II

INDOOR FACILITIES

Figure		Page
1	Teaching Stations at Sinclair Community College	21
2	Suggested Indoor Surface Materials	21
3	Levels of Illumination Recommended for Specific indoor Areas	23
4	Illumination Levels for Indoor Tennis	24
5	Suggested Needs for Electrical Service	27
6	Gym with Suspended Track at Ohio State	37
7	NCAA Basketball Court Diagram	37
7A	Volleyball Court Dimensions	38
8	Multi-Station Conditioning Machines	39
9	Wrestling Mat Layout and Picture	40
10	Squash Court Dimensions	40
11	Racquetball Court Dimensions	39
12	Fencing Strip Layout	41
13	Indoor Regulation Rifle and Pistol Range	42
14	Commercially Produced Golf Station	44
15	University of Nebraska at Lincoln Dance Studio	44
16	University of Denver Dance Studio	44
17	Badminton Court Dimensions	44
18	Space for Selected Indoor Activities	47

Chapter III

OUTDOOR FACILITIES

Figure		Page
1	Isolation of play areas by use of dividers	55
2-3	Location of play fields	56
4	Illumination levels for outdoor sports areas	61
5	Baseball Diamond Layout	63
6	Layout and Grading Details - Boys' Baseball Fields	64
7	Little League Baseball	64
8	Pony League Baseball	64
9	Babe Ruth League	64
10	Softball Diamond	65
11	Field Hockey	66
12	Flicker Ball Playing Field Layout	66
13	Flicker Ball Goal	67
14	Flicker Ball Fields	67
15	Football Field	67
16	Lacrosse Field	68
17	Rugby Field	69
18	Soccer Field	69
19	Speedball Field and Goal Posts	70
20	Team Handball Field Layout	71
21	Team Handball Goal Details	71
22	One Wall Handball Court	72
23	Three Wall Handball Court	73
24	Shuffleboard Court	73
25	Tennis Court Layout	77
16	Middle Tennessee State University Tennis Courts	77
27	Platform Tennis Court	76
28	Layout of 440 Yard Running Track	78
29	Shot Put and Hammer Throw Circle	80
30	Shot Put Stop Board	80
31	Sector Layouts - Shot Put, Hammer Throw, Discus Throw	80
32	Discus Throw Circle	80
33	Sector Layout - Discus Throw	80
34	Javelin Throw Layout and Scratch Board	81
35	Long Jump, Triple Jump and High Jump Layouts	81
36	Pole Vault	81

Chapter IV

INDOOR AND OUTDOOR SWIMMING POOLS

Figure		Page
1	Growth of Swimming Pools by Type	88
2	Number of Pools by Area	89
3	Minimum Recommended Occupancy Design Factors	85
4	Minimum Dimensions for 1 and 3 Meter Springboard	91
4A	Minimum Standard Diving Facility Dimensions	90
5	50 Meters x 25 Yards, 2 Movable Bulkheads	92
6	45 Feet x 120 Feet with a Movable Bulkhead	94
7	Multiple Pool Complex	95
8	"L" Pool, 25 Yards x 25 Meters, 25 Yards x 45 Feet Area of Deep Water, for Polo, Scuba, Synchro and Life Saving	96
9	25 Meters x 45 Feet, Minimum Competitive Pool	96
10	25 Meter x 75 Yard Pool	98
11	Rapid Flow Sand and Gravel, High Rate Sand, or Pressure Diatomaceous Earth Filter System	99
12	Vacuum Diatomaceous Earth Filter System	99

Chapter V

ENCAPSULATED SPACES AND STADIUMS

Figure		Page
1	Satellite Concept - Ohio State University	103
2	Satellite Concept - University of Michigan	103
3	Hyperbolic Paraboloid Modular System	104
4	Systems Engineered Modular Natatorium	104
4A	Iceland Arena	104
5	Tensile Construction	105
6	Supported Membrane Construction	105
7	Supported Membrane Construction	105
7A	Domed Roof Design	106
8	Triple Geodesic Domes	106
9	Domed Roof Design	106
10	Net System for Dividing Space	107
11	Idaho State University Mini Dome	108
12	Exterior View of Northern Iowa University UniDome	108
13	Interior View of Northern Iowa University UniDome	108
14	Interior View of University of Idaho Kibbie Activities Center	109
15	Olympic Swim and Racquet Club Air Structure	109
16	Masterplanning - Building by Phases	110
17	Sight Lines and Focal Points	110
18	Ice Rink Layout Design	114
19	Ice Rink Layout Design - Minimal Seating	115
20	Indirect Refrigeration System	116
21	Direct Refrigeration System	116
22	Pre-Assembled Refrigeration Unit	117
23	Michigan State University Ice Rink	118

Chapter VI

SERVICE AREAS

Figure		Page
1	Location of Lockers and Showers	123
2	Combining Open and Private Showers	125
3	Suggested Methods of Using Flexible Shower Rooms	125
4	Pedestal Shower Installation	126
5	Locker Area Traffic Flow	128
6	Shower Head Arrangements	128
7	Shower Room Features	129
8	Lavatory Fixtures for the Handicapped	129
9	Storage - Dressing Locker Arrangements	130
10	Dressing Locker and Box Storage Arrangements	130
11	Central Issue System	132
12	The Tote Basket System	132
13	Dressing Bench Arrangements	133
14	Combination Locker System	133
15	Teams Lockers and Individual Stalls	134
16	Athletic Team Locker Room	134
17	Locker Room Separate from School	135
18	The Team Locker	135
19	Athletic Storage Room	135
20	Suggested Laundry Room Layout	136
21	Athletic Training Room	140
23	Auxiliary Training Room	138

Chapter VII

RECREATION AND PARK AREAS AND FACILITIES

Figure		Page
1	Battelle Health Fitness Center	146
2	Table Tennis	149
3	Billiards and Pocket Billiards	149
4	Teen Center	151
5	Tennis Club	153
6	Tennis Club Interior	153
7	Racquetball Club	153
8	Racquetball Club Interior	153
9	Hopscotch	157
10	Bocce Court	153
11	Horse Shoes	158
12	Neighborhood Playground	159
13	Citywide Park	160
14	Bike Trail	161
15	Bicycle Facility Planning Process	162
16	Horse Show Rings	163
17	Exercise Trail	164-5
18	Exercise Station	166
19	Alpine Slide	167
20	Marina	168
21	Platform Tennis Court	169
22	Ice Hockey	170
23	Curling	170
24	Skeet Field Layout	171
25	Trap Field Layout	174
26	Combination Skeet and Trap Field Layout	172
27	Smallbore Rifle and Carbine Range	173
28	Archery Target Details	175
29	Archery Range Layout	175
30	Overnight Camp Unit	182

Chapter IX

TRENDS IN FACILITY DESIGN

Figure		Page
1	Climbing Wall	202
2	Ski Ramp	202
3	Flexible Teaching Areas	202
4	Solar Heating	203
5	Roof Top Use for Activity	203

I. The Planning Process

1. The Planning Process

The Planning Process

THE CRUCIAL YEARS are now! The quality and quantity of educational spaces that we build will reflect our wisdom for generations. The consequences of making mistakes in constructing and equipping facilities will result in time wasted, dollars spent unwisely, and more importantly, affect the quality of future recreation.

Planning new or rehabilitating existing facilities is founded on several general concepts. These are:

1. The costs of materials and services is rising. Land is less readily accessible, thus more expensive. The cost of converting raw products into finished building materials increases monthly while hourly wages of skilled labor increase. As a result of the shrinking dollar, construction bond issues are being defeated with regularity.

2. Education is changing. Desegregation rulings have presented new educational problems. Federal legislation relating to women, minorities, and the handicapped has added dimensions to the already complicated scene.

3. It is commonly believed that capital outlay consumes the major portion of the education/play dollar. It does not. The major costs of the education/play enterprise are personnel, maintenance, and utilities, not bricks, mortar, stone and grass.

4. Great zones of space should be planned rather than little boxes. To design space to fit today's needs, leaving no alternative to our successors but to tear down and build anew, is to demonstrate an unwise guardianship of a public trust.

5. Heavily used spaces should be of high quality. Today's economy forces a compromise between what should be built and what can be afforded.

6. The school, college/university and recreation facility should be extended into the community. This applies to facilities as well as programs. Inter-agency cooperation is imperative.

7. Energy cost and energy conservation must be considered in facility design and construction.

People resist change. Often, change is accomplished only in response to outside pressure. Yet, if people, who are reluctant to initiate change are presented with a number of options, their fears become less compelling and progress can be measured.

Basic Considerations

Before considering the planning of areas and facilities essential for athletics, physical education, and recreation, it is important to understand their basic aims and objectives.

Athletics and Physical Education

The aim of athletics and physical education is to help people live healthy, satisfying, and energetic lives by developing and maintaining optimum physical efficiency, by developing useful knowledge and physical skills, by acting in socially useful ways and enjoying wholesome physical recreation.

Physical education is the science and skill of movement. All types of sports and activities are used to develop the strength, endurance and coordination essential in both work and play. Through activities, youths and adults are taught the physical skills needed for performing daily work, conditioned through exercise and sports for the maintenance of mental and physical health, and taught the skills that form a part of leisure pursuits.

A school activities program includes participation in appropriate activities for all pupils, a wide variety of intramural activities, and, at the secondary school level, a broad program of interscholastic athletics for those of above average athletic ability and interests.

Recreation

The primary function of recreation is the enrichment of living by enabling individuals to find adventure, fellowship, a sense of accomplishment, the enjoyment of beauty, and the joy of creating, all of which contribute to human happiness. Through recreational programs, people develop interests and skills that enable them to make constructive use of leisure, contributing to proper physical and mental health, safety, good citizenship, confidence and character development.

Recreational activities include games and sports, music, dance, arts and crafts, drama, social activities, nature and outing activities, hobbies, and service projects. The comprehensive recreational program affords people of all ages, backgrounds, and interests, the opportunity to engage in a variety of activities. Trained leadership and desirable conditions assure enjoyment and benefits.

Need for Areas and Facilities

The widening impact of athletics, public recreation, and physical education has aroused the public to the importance of more programs, facilities, and services. Recent court decisions requiring equal or comparable programs and facilities for females have a tremendous effect upon the use of present facilities and will result in demand for new facilities.

Interest in a wide range of recreational activities has had a phenomenal growth, as reflected in the demand for facilities required for organizing camping, water and winter sports, and the performing arts. Schools and colleges have increasingly accepted the responsibility for teaching skills that contribute to the satisfying use of leisure.

A primary consideration, in meeting the aims of an institution or agency considering the construction of a new facility, is a sound philosophy. The facility will reflect the philosophy of those persons involved in program administration and development. To achieve the desired facilities, a logical sequence of events must take place, employing program specialists, architects, engineers, financial advisors, and various survey evaluations.

Need for Planning

Today, we face a rapidly changing environment. The interplay of social, political, economic and technological forces affects all institutions. Scarcity of resources in the face of ever-increasing demands, and subsequent spiralling costs, have had a dire effect on institutional budgets. Education has been affected by these trends which have ushered in "the age of accountability," requiring justification of expenditures both for existing and new programs and facilities. Educators and other planners must face this reality.

Education claims a large piece of the tax dollar. Perhaps the costliest of all education services and facilities are those related to physical education, recreation, and athletics. It is not unusual for 25 to 50 percent of the total construction cost of any new high school to be spent on the physical education plant. An Educational Facilities Laboratory report provides a further analysis of costs, indicating that the average enclosed heated area at the high school level devoted 22% to physical education facilities and 15% of the school building dollars are invested in physical education.

Obviously, the need for sound planning and justification of physical education, recreation, and athletic facilities is imperative. If facilities for physical education, recreation and athletics are to be justified economically, then time, effort and money must be invested in planning. The end result will be the provision of better facilities at less cost for broader participation by program users.

Community Involvement and Interagency Cooperation

Traditional methods for planning recreational and physical education facilities have caused agencies to operate independently of one another. This isolation has resulted in public agencies being accused of duplicating facilities and programs, and frittering away community resources.

Traditional planning has often meant statistical planning or hardline planning. Decisions have resulted from taking given sets of data and projecting the program and facility needs. Other types of planning are "political" planning and "grass roots" planning. The former is a decision-making method used to influence certain segments of the population. The latter frequently evolves from negotiations with these segments for certain programs and services. These are giving way to new methods of participatory planning.

Whether elected officials, administrators, representatives from other agencies, community members, students, program participants or taxpayers, all must be concerned with the well-being of the community. Further, each has much to offer to a planning process which can result in the development of programs and facilities which are needed, desired, and supported.

Whether planning for a university physical education complex or for a rural community center, the needs and desires of those who are to be served, those who serve, and those who must provide financial support for the project, are of utmost importance. The following considerations must be observed:

- Improved coordination and delivery of services.
- Improved opinions toward public institutions.
- Facilities which reflect the needs and desires of the community.
- Accountability-efficiency (biggest "bang for the buck").

One method in which the above can be accomplished is through a participatory planning process. The steps in conducting a participatory planning process are listed below.

Steering Committee

Develop a steering committee that includes inter-agency representatives of elected officials, administrators, community representatives, and other pertinent individuals. This group should be diversified to insure representation of as many segments and opinions of the community as possible.

Needs Assessment

Develop procedures for identifying the needs and desires of the community, as well as what the community is willing to support. Preferably, this is done by the steering committee.

Data Base

Develop a data base composed of demographic, programmatic, facility, financial and other related information. Most communities have three or four planning departments from which data can be obtained.

Synthesis

Compare survey results and statistical information to determine program and facility priorities.

Public Forum

Conduct public hearing(s) to obtain community input to supplement needs assessment results.

Task Force

Develop a series of task forces in each of the major priority areas. The task force should be chaired by a community

member, and agency representatives should be assigned to the appropriate task force. Each task force is to examine the ramifications of each priority area.

Alternative Solutions

The steering committee, after weighing the task force recommendations, should develop alternative solutions for meeting the needs and desires of the community.

Public Forum

Each task force reports its findings. The steering committee reports the alternative solutions based on the recommendations of the task force. The meeting concludes with the identification of the preferred alternatives.

Policy Boards

Preferred alternatives are submitted to policy boards of public agencies for approval. If changes are made, or there are other limiting factors which were not anticipated, repeat the last two steps.

Advantages of Participartory Planning

- Elected officials, administrators, citizens and others work together for the development of common goals
- Citizen involvement from beginning to end.
- Hard-line statistical information used to its maximum benefit.
- Input *into* decision-making, rather than reaction *to* decisions made.
- The possibility of duplication of services, programs, and facilities is limited.
- Maximum use of community resources and other potential funding sources is provided for.
- Communities and agencies work in cooperation rather than in isolation.
- Improved communication is achieved between groups and total community.
- Increased understanding of the needs and desires of the community and increased community understanding of public institutions results.
- Improved support, credibility, and understanding is achieved.

Planning for the Handicapped

Federal laws in the Education for All Handicapped Children Act (P.L. 97-142) and Section 504 of the Rehabilitation Act of 1973 (P.L. 93-112) and parallel state laws require that students with physical and mental impairments be included to the maximum extent possible in regular physical education classes.

Despite federal legislation, state mandates, and local regulations, facilities of all types continue to be built and renovated without consideration of accessibility to handicapped individuals. These situations not only affect individuals with permanent or obvious physical conditions, but those with temporary or hidden conditions as well. People with baby strollers, persons who must temporarily use crutches, those wearing leg braces, or individuals with heart conditions are just a few affected by architectural barriers resulting from poor planning.

Planning must acquire a knowledge of federal and state legislation, local building codes and construction concepts related to the special needs of the handicapped. More importantly, the planner must do everything possible to insure that all laws and guidelines are implemented in the planning and construction phases. The building's total environment must be available to everyone. A more detailed treatment of this subject may be found in *Making Physical Education and Recreation Facilities Accessible to All: Planning, Designing, Adapting.* Washington, D.C.: AAHPER, 1977 (See also: Chapter VIII).

Both supervision and security relate to legal liability and should be considered during the planning phase. The design of buildings should focus on central inspection points where traffic can be controlled with a minimum of personnel. Such control points would include: building and natatorium entrances and exits, concession areas, equipment check-out points and internal activity areas such as handball courts, rifle and archery ranges. The planner, familiar with the programs which the building will accommodate, must identify these points of effective supervision.

Negligence, that aspect of liability which is interpreted as an improper action or a lack of action on the part of a reasonably prudent person, is closely related to the supervision function. It is the primary allegation in most litigation brought against the professional. While litigation involves a supervisory authority, the faulty design and/or maintainance of a facility often is the unseen contributory cause of the incident that precipitated the legal action. Examples of faulty facility design might include: narrow stairwells, locker rooms and swimming pools on two separate levels requiring use of a stairway, obstacles blocking sight lines on playing fields, improper lighting in gymnasiums and swimming pools, misalignment of locker rows, poorly designed backstops, and improperly hung doors. These and the many other examples of faulty design must be anticipated and eliminated by the planner.

Security is a planning function, usually considered in two phases — design construction, and implementation safety. The planning phase will include consideration of: a comprehensive master/submaster key system, traffic patterns, monitoring control points, number of emergency exits, location of entrances, the building's communication system, sectioning the building for specific use functions, type of lockers, fire doors, windows, and outdoor building lighting and landscaping.

Building safety includes: proper distance between court markings and walls, padding of walls and posts, provision of hand and/or guard rails where necessary, accessibility to rescue and life support equipment, proper lighting, non-slip floor surfaces, traffic passageways free of obstructions, and proper drainage in shower areas and pool decks.

Security measures and safety procedures should be designed for simplicity of operation. The more complicated and time-consuming it is to secure a facility and its equipment, the less likely that it will be done properly. There is little doubt that within areas of physical activity it is impossible to eliminate every situation which could lead to an accidental injury. However, planners must make every effort to design a facility that will minimize the potential for unauthorized use, injury and vandalism.

Maintenance Considerations

Of prime consideration in the planning of a building is the provision for the efficient completion of daily maintenance

chores. The custodial engineer should have direct input in planning for maintenance service spaces. Daily, weekly and monthly custodial services need to be programmed efficiently by building supervisors. Failure to carry out effective routine cleaning and maintenance is costly when judged on a long term basis. Planners and building supervisors are referred to Appendix A for a useful check list of systematic cleaning and maintenance.

Long-Range Planning

Success or failure in the planning and construction of facilities is the direct result of planning. Mistakes in construction are costly, and can handicap programs for which the facility was designed. Because of new and changing programs, the building needs of institutions are often not satisfied in the original construction phase. Long-range planning is imperative in order to facilitate the expansion of facilities in the most efficient and economical way in meeting the needs of a changing program. Educational and recreational agencies should have *master plans* which should be continually evaluated and reorganized in meeting needs of the present and the future.

Many people do not understand the need for large expenditures in the field of physical education. As a result, funds may not be readily approved for expensive facilities and equipment. Physical educators must demonstrate the need, through careful planning, and present a well-organized plan for proposed facilities in justifying the needs of the program.

Without long-range planning, buildings become outdated before their 40-50 year life expectancy. Long range planning should include the following considerations:

1. A copy of the master plan for future expansion.
2. Data related to developmental trends in the community (including demographic and other sociological data).
3. The current master plan for future development of the city.
4. A topographical map of the area surrounding the community.
5. Detailed information concerning property adjoining a school that might be available for acquisition.
6. Folders of clippings, pictures, detailed drawings of other facilities that relate to future needs.
7. An annotated bibliography of up-to-date references relating to physical education facilities.
8. A cumulative list of common errors of design and construction with details of where they can be seen and studied.
9. Blueprints of all existing outdoor and indoor facilities.
10. Accurate information related to length of seasons, rainfall, temperature range, winds, soil composition and drainage.
11. Information relative to various means and sources of raising money.
12. Sources of planning aids for facility development.

Long-range planning requires much time spent in the searching, evaluation, and coordination of information and ideas. Specialists in the field of health, physical education, recreation, and athletics should serve as consultants and be involved in the long-range planning of their programs and facilities. Program specialists must be included on the long-range planning team.

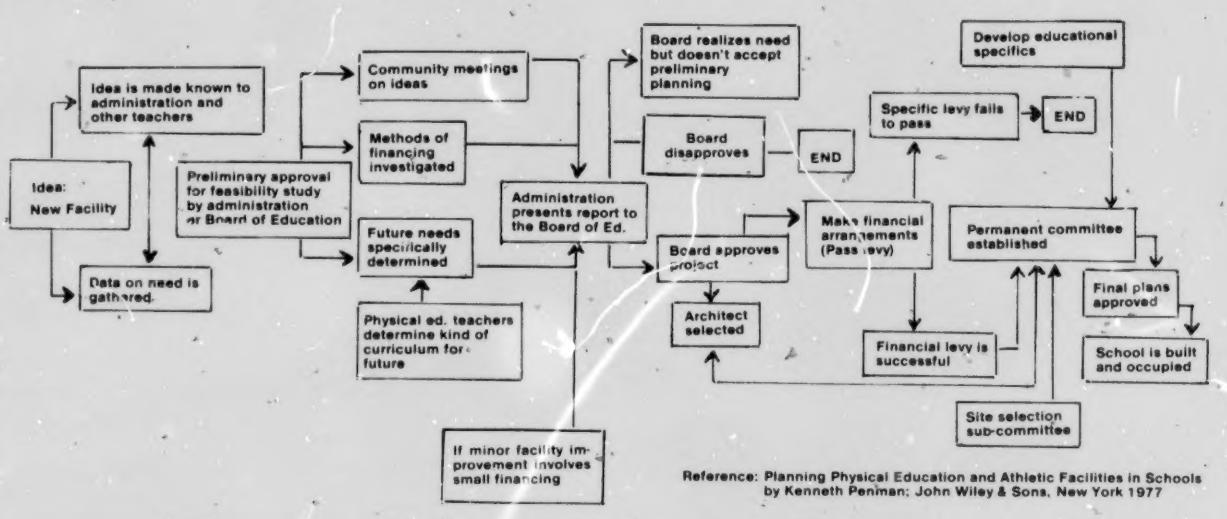
Planning Stages

The planning committee must be able to demonstrate the need for a proposed facility. Much of the preliminary data should already have been gathered by the long-range planning committee.

Figure I offers one example of an interesting planning model. It includes the various stages required for planning any new facility, such as a public high school. While some appropriate modifications would be necessary for a college or recreation agency, the diagram provides important and useful insights as to the complexities involved in the planning stages. The boxes with heavy lines indicate those stages in which it is particularly important for physical educators to become involved.

Figure 1

A SAMPLE PLANNING MODEL FOR PHYSICAL EDUCATION FACILITIES DEVELOPMENT FOR A SCHOOL


Idea: New Facility
Idea is made known to administration and other teachers
Data on need is gathered.
Preliminary approval for feasibility study by administration or Board of Education
Community meetings on ideas
Methods of financing investigated
Future needs specifically determined
Physical ed. teachers determine kind of curriculum for future
If minor facility improvement involves small financing
Administration presents report to the Board of Ed.
Board realizes need but doesn't accept preliminary planning
Board disapproves
END
Board approves project
Architect selected
Develop educational specifics
Specific levy fails to pass
END
Make financial arrangements (Pass levy)
Financial levy is successful
Permanent committee established
Final plans approved
School is built and occupied
Site selection sub-committee

Reference: Planning Physical Education and Athletic Facilities in Schools by Kenneth Penman; John Wiley & Sons, New York 1977

Aims and Objectives:

A planning committee must realize that it is *curriculum and related programs which dictate the planning of facilities.* Therefore, all facilities should be justified in relation to the educational objectives. Four specific objectives have been endorsed by the American Alliance for Health, Physical Education, and Recreation for its programs:

- To develop and maintain maximum physical efficiency.
- To develop useful knowledge and physical skills.
- To act in socially useful ways.
- To enjoy wholesome physical recreation.

Specific Factors to be Considered in the Planning Process.

A number of specific factors which have significantly influenced and altered concepts of facility planning, development, and construction, must be considered in new physical education facilities. These include:

- Enrollment trends.
- District consolidations of schools.
- Present and proposed programs.
- Innovative methods of instruction.
- Soaring construction costs.
- New systems approaches to building.
- Development of new construction materials.
- Health needs of participants.

Steps in the Planning Process.

Aside from costs, perhaps the most significant variable in establishing the need for facilities is the philosophy that shapes the form of each community's education. Facilities must be designed to be compatible with that philosophy. The planning committee must seek answers to questions such as: Is it a traditional system, or does it encourage experimentation? Are the schools run independently of other public agencies or is cooperation encouraged? Is the community able to pay for quality education? Is there general support for sports programs?

Preliminary survey

Answers to these and many other questions can help predetermine what can be expected for a program and facility. A district-wide survey is the initial step for the planning committee, and can serve as an important source of essential data in providing answers. It will also provide other important information such as attitudes, interests, desired curriculum, and projected enrollments. Survey committees should include several members of the physical education or recreation staffs. Once the survey is completed, the planning committee can proceed with appropriate action, including assignment of program specialists to specific subcommittees.

Educational Planning

This phase requires the specific, detailed cooperationand contributions of the physical education and athletics staff. Educational planning is characterized by four distinct elements of responsibility:

- *Establish the details of the curriculum and specific activities for the various program needs, including instructional areas, clubs, intramurals, and athletics.*
- *Calculate the number of teaching stations needed, considering enrollment, requirements, and other factors.*
- *Develop room and other space specifications (considering such factors as locations, locker facilities, storage, services, size and shapes).*
- *Compile the Educational Specifications (EdSpecs). This is the final phase, and will require the cooperative efforts of all the subcommittee program specialists. EdSpecs are prepared for the architect as a guide. These are essential to describing the learning activities that will occur, the numbers groupings, and nature of the people involved: the space relationships, the interrelationships of instructional programs; major items of furniture and equipment; minimum and standard dimensions and markings; and any special environmental provisions required for learning and efficiency.*

Guiding Principles in Planning

The preceeding discussion has addressed itself to a brief description of the primary phases involved in planning a new facility. Understanding how these phases contribute to the end result will facilitate the work of the various subcommittees in a more meaningful and organized manner. All efforts should proceed on the basis of sound guiding principles, as follows:

- Physical education/recreation/athletic (PERA) facilities should be developed and coordinated as a part of the total school master plan.
- Facility design must take into consideration the future long-range needs for the building and be planned as a functional segment of the total anticipated building.
- Physical education and athletic personnel should be involved in the early planning.
- Educational consultants should be invited to participate in the planning and to evaluate the work of the planning group.
- The facilities should be designed for flexibility in order to provide for a full program of activities.
- Facilities should be located in areas that are easily available to students, but provide isolation from other instruction.
- Safety, and healthful environment, should be given prime consideration in facility design.
- Planning must be realistic in the light of the financial situation of the community.

The above list is hardly complete. Each institute must determine those guiding principles that will best fit its own situation.

Survey and Evaluation of Existing Facilities

Educators must ensure that physical education and athletic facilities adequately support the curriculum and the enrollment load of their institutions.

The initial step is to make a survey of existing facility spaces, areas and features concerning their number, size, composition, and location. The data should be compared to existing accepted standards. This evaluation may reveal in-

Figure 2
Facilities Survey and Evaluation Chart

NOW = PRESENT PROGRAM AND ENROLLMENT
FUTURE = PROJECTED PROGRAM AND ENROLLMENT

1	2		3	4		5		6		7				8
SPACE SURVEYED OR SPECIFIC FEATURES WITHIN THE SPACE	NATIONAL STANDARD AS APPLIED TO THE SITUATION SURVEYED		SQ. FT. OR NUMBER WE HAVE	% OF STANDARD WE HAVE		% OF STANDARD WE NEED		AMOUNT OR NUMBER WE NEED TO MEET STANDARD		CONCLUSIONS OUR SPACE IS:				REMARKS
										ADEQUATE		INADEQUATE		
	NOW	FUTURE		NOW	FUTURE	NOW	FUTURE	NOW	FUTURE	NOW	FUT.	NOW	FUT.	
						EXAMPLES								
GIRLS' LOCKER ROOM [a]														
(1) AREA	2400 sq. ft.	3000 sq. ft.	1800 sq. ft.	75%	60%	25%	40%	600 sq. ft.	1200 sq. ft.			✓	✓	
BOYS' SHOWER ROOM [b]														
(1) SHOWER HEADS	33	40	22	67%	55%	33%	45%	11	18			✓	✓	
(2) WALLS	SMOOTH MATERIAL	IMPERVIOUS	TILE	—	—	—	—	—	—	✓				
(3) etc. ADDITIONAL FEATURES														
TENNIS COURTS [c]														
NUMBER	20	25	12	60%	48%	40%	52%	8	13			✓	✓	
(2) FENCING	REAR: 12 FT. HIGH SIDES: 10 FT. HIGH		ALL 12 FT.	—	—	—	—	—	—	✓				
(3) etc. ADDITIONAL FEATURES														
SOFTBALL FIELDS														
(1) NUMBER	NO PRESENT NATIONAL STANDARD		2	—	—	—	—	—	8	✓			✓	ADDED FUTURE ENROLLMENT
(2) SIZE (EACH)	275' x 275'		EACH 310' x 300'	100%	—	NONE	—	NONE	—	✓				
(3) etc. ADDITIONAL FEATURES														

a NATIONAL STANDARD: 20 SQ. FT. PER STUDENT AT PEAK LOAD
EXAMPLE: NOW — 120 STUDENTS x 20 SQ. FT. = 2400 SQ. FT.
FUTURE — 150 STUDENTS x 20 SQ. FT. = 3000 SQ. FT.

b NATIONAL STANDARD: 10 SHOWER HEADS FOR FIRST 30 PEOPLE, ONE HEAD FOR EACH ADDITIONAL 4 PEOPLE AT PEAK LOAD
EXAMPLE: NOW (120 STUDENTS) FOR FIRST 30 = 10 HEADS
120 – 30 = 90 ÷ 4 = 23 ADDITIONAL HEADS
= 33 TOTAL SHOWER HEADS

FUTURE (150 STUDENTS) FOR FIRST 30 = 10 HEADS
150 – 30 = 120 ÷ 4 = 30 HEADS
= 40 TOTAL SHOWER HEADS

c UNIVERSITY NATIONAL STANDARD: ONE TENNIS COURT PER 400 STUDENTS OF APPLIED STUDENT POPULATION
EXAMPLE: NOW — $\frac{8000 \text{ STUDENTS (A.S.P.)}}{400} = 20$ COURTS FUTURE — $\frac{10{,}000 \text{ STUDENTS (A.S.P.)}}{400} = 25$ COURTS

adequacies which need to be rectified. In order for the administration to make a decision to modify existing facilities or to construct new facilities, and to approve the necessary funding, it must be proven conclusively that the improvements are needed. Sound data is required to support and illustrate the case.

The architect, with the assistance of the planning team, should ensure that all planning conforms to state and local requirements and to accepted standards. The standards are meant to be guides, but there may be appropriate deviations due to the local curriculum or situation. The physical educations program specialist can be most effective in ensuring that accepted standards are met for both present and projected needs.

The survey and evaluation should be conducted by the most knowledgeable and experienced members of the professional staff, in consultation with the people most directly involved with the use of each space or area. Outside consultants may also be of assistance in order to ensure the thoroughness of the survey and evaluation. It is recommended that a *Facilities Survey and Evaluation Chart* be used.

Column (1): List each space or area, with the specific features of that space or area sublisted.

Column (2): Using existing national standards, or in some cases, state standards, compute the size or number which the standard indicates is applicable to the enrollment and curricular situation of the institute being surveyed. List this figure for each corresponding space or area in column 1. These applied standards should be expressed in two ways in Column 2: for the present program and enrollment, and for the projected program and enrollment. The standard for walls, ceilings, drains, etc., is usually verbalized (see example). Facility spaces which are recommended by national standards may be listed, even though the institution does not have them. Make notations in subsequent columns to show whether this item is or is not needed. For example: a swimming pool may be recommended but not needed since an adjacent community pool is available. Or a dance room may not exist but the curriculum indicates that a dance room is needed.

Column (3): From the survey, list the data found for each space, area, or feature.

Column (4): Compute the percent of the standard found in the space surveyed. Do this for both the present situation and for the projected future program and enrollment.

Column (5): Compute the percent needed to meet the standard, present and projected.

Column (6): Compute the amount or number needed to meet the standard, both for the present program and enrollment, and for the projected program and enrollment.

Column (7): Conclusions are drawn and marked indicating whether or not the space, area, or subfeature is adequate now and for future projections:

7.1 Adequate for present program and enrollment

7.2 Adequate for projected program and enrollment

7.3 Inadequate for present program and enrollment

7.4 Inadequate for projected program and enrollment

Column (8): The Remarks column may be used to record comments concerning the area; to explain deviations from national standards deemed appropriate due to local situations or curriculum; or to indicate the unacceptability of the national standard if local conditions or experience so warrant.

Space does not permit a complete presentation of a *Facilities Survey and Evaluation Chart* for all areas, spaces, and courts likely to be surveyed, nor to list all the subfeatures of them. The example serves as a suitable guide in making up such charts. If a number of schools in a district are to be surveyed and the results compared, a common chart could be developed with code numbers assigned to: (a) each area, space or court; (b) dimensions, square footage or numbers; (c) specific sub-features. Thus the data could be computerized to facilitate handling and comparison.

The *Facilities Survey and Evaluation Chart* may also be used in planning a new facility. The spaces, together with their computed sizes, numbers and features, based on national standards, as applied to the local situation, would be charted in columns (1) and (2). The plans then would be drawn up to incorporate these standards both for the present and for the anticipated programs and enrollment. If the work to be done involves remodeling or adding to an existing facility, a survey and evaluation should be made of the existing facility.

Team Approach to Planning

Depending on the extent and complexity of the project, some form of team planning will be needed at each stage. It is seldom that the best results ever evolve from a one-person planning operation. The various steps outlined would be appropriate for any facility project.

Stages of Team Approaches to Planning

Conceiving the Idea at the Basic Program Level

A particular unit within the whole physical education, recreation, athletics (PERA) area may develop an idea for a new facility, for facility improvement. Before exploring the idea with its parent division, it should first carefully think through the need and feasibility. If the idea is a new swimming pool, unit personnel should be prepared to defend the idea before colleagues, giving the reason for priority over new tennis courts, auxiliary gymnasium, a baseball facility, or other possible facility needs.

Usually, there is a period when a facility need is evident and before it actually is planned. During this period, the personnel most directly related to the proposed facility should begin an informal public relations approach to their colleagues who eventually must approve such a proposal.

Presenting the Idea to Higher Authority

After the originating personnel have convinced its PERA division that its project should hold the highest priority, a planning team representing the total division should be selected to review the initial proposal, modify, approve, and expand on the various phases of it before presenting it to the higher authority. Quite obviously, representation on the planning team should include personnel from the group that originated the proposal.

But in the meantime, long before submitting a finished proposal to a higher authority, an unofficial awareness and enlightening program can begin with higher administrative personnel. This can consist of informal "dropping of ideas", or forwarding copies of related materials. The PERA division should be alert to who, in higher authority, might be most sympathetic to their project.

Cooperative Effort to Prepare Proposal to Highest Authority.

Some colleges/universities, school systems, and recreation departments can be quite complex while others are relatively simple. In some situations, Step 2 may be the final step in gaining approval. Often there is an intervening step which requires an overall planning committee or board to evaluate a proposal. If this group looks favorably on a PERA project, one of two actions usually results. It may be that the PERA project committee is allowed to present its facility proposal for final approval.

If, on the other hand, the overall planning committee is expected to make a presentation, this committee needs to include personnel from the PERA committee in order to ensure making the best possible presentation. In the latter case, the presentation needs to be well-integrated, showing the highest priority of the project, not only when compared with other PERA projects, but more importantly when compared with other projects in the system.

Consulting firms offer special services in educational planning. This service can be comprehensive or of a specific nature, depending on the client. Some institutions employ such firms to assist in their more complicated development plans.

Establishing a Public Relations Team

Step 4 and 5 can be started simultaneously if the project is to be presented to the public for approval. The Steering Committee should have the single responsibility of accomplishing this goal. All the facts should be furnished to conduct a program for the various media and personnel in order to create a favorable public reaction prior to any voting. It should be noted that a last minute publicity campaign to gain approval seldom is successful unless it has been preceded by a concientious on-going public relations program. If the project is a swimming pool for the school system, the success of the campaign will depend upon the impression that the school system, the athletic program, and perhaps the recreation program, have made with the public. Any system which can demonstrate a recurrence of successful building projects can also demonstrate a continuous public relations program to its public.

Preparing the Program Statement for the Architect.

Once a project has been given the approval for detailed planning by the highest authority in the system, a team needs to be established to accumulate and systemize all information that would be valuable to the architect in designing the facility. The team normally would consist of a representative from the PERA division, a member of the highest planning unit in the system, perhaps one administrator and principal from the architectural firm to give direction. Each of these individuals, particularly the PERA representative, will depend on other personnel to furnish desired data, but this smaller committee is responsible for accumulating it and preparing a final coherent and systematic format.

Program-Oriented Team to Work With the Architect.

The group that ultimately does most of the work, and/or makes most of the crucial decisions, is the planning committee of the PERA division. It is this group that has the responsibility of reacting to the architect's initial concepts and schematic drawings. They will need to coordinate the planning within the various components of the facility (Note Item 7). In addition, they will need to react to many last minute questions dealing with interpretation, proposal change, and possible deletions. There should be an understanding with the architect that no changes in plans will be made without first having the input of the committee. It is recognized that some decisions take an immediate answer and the chairman of the planning committee will have to make some of these decisions alone, often over the telephone. Crisis decisions should be kept to a minimum.

Sub-Unit Teams in More Complex Facilities

It is to the advantage of the builders to have the most knowledgeable people plan with the architect any unique features or areas of a facility. For example, if a physical education complex is being planned that contains gymnasium, pool, wrestling room, dance studio, and total service areas, sub-committees should be established for each. Sub-committees should be encouraged to think "big".

The architect's role is to relate these plans with the reality of the Program Statement and plan accordingly. Often, the Planning Unit will not have the necessary specialists for the sub-committees structure. In such cases, it may become the responsibility of one member of the planning committee to gain the necessary information.

The team approach at any level may be more time-consuming but results in better planned facilities. When using this planning process someone at each level has to be given the ultimate responsibility for communicating suggestions to the next highest level.

In summary, there are a number of different approaches to organizing the planning team. Each of these approaches are often identified as follows:

1. Joint Planning Team (Administration, Faculty, Architect, Consultants, Students, Community).
2. Faculty Planning Team.
3. Outside Consulting Team.
4. Central Staff Planning Team (Large District).
5. Superintendent and Architect.
6. Capital Improvement Planning Division (Recreation).

In the case of PERA projects, the above approaches (1-5) are listed in a descending order of preference. By far the most productive planning team approach is the one identified as the Joint Planning Team. Such an approach best assures the correct defining of the problem before the specific planning is begun. It provides an excellent personnel mix for challenging and extending concepts. In addition, it can provide an opportunity for an increased attitude of cooperation between the various parties concerned.

Writing the Program

The *Program* is the document that should be written well in advance of selecting the architect. It is a statement that will be used to communicate the needs of the school program to the architect and the central planning committee.

This document has a variety of names. Some architects call it *The Program.* Some educators call it *The Educational Specifications.* Others call it *The Building Program.* By whatever name it is called, this important statement should be written in an organized manner.

The objectives should be to put into writing the current and anticipated school programs to be offered and determine the facilities required for the proposed programs.

Some guidelines for writing *The Program* include the following:

- The document should be concise.
- State the optimal as well as the minimal program needs.
- Make sure the project is rooted in fiscal reality.
- Conduct a critical evaluation of the current programs to determine if new programs should be emphasized, old ones should be eliminated, or old and new combined.
- All indoor and outdoor facility needs should be considered.
- Be aware that the location of facilities will affect the program offered.
- The initial rough draft of the document should be distributed to all contributors for review and comment.

The organization for writing *The Program* may vary. An acceptable way of dividing up the work load is to establish a number of sub-committees, or sub-unit teams. Each person serving on a sub-committee presumably is an expert in his area. One suggested sub-committee structure follows:

1. Adapted
2. Administration
3. Aquatics
4. Individual and Dual Sports
5. Dance
6. Games and Outing Activities
7. Science
8. Self-Testing and Combatives
9. Service Areas
10. Team Sports

The following is a suggested outline of *The Program:*

Part I. Objectives of the School Programs:

A. Instructional (Professional and Service)
B. Intramurals
C. Adapted
D. Athletics (Interscholastic and Intercollegiate).
E. Club sports
F. Community-School programs
G. Others

Part II. Basic Assumptions to be Addressed:

A. Facilities will provide for a broad program of instruction, adapted, intramurals, athletics, club sports, and others.
B. Facilities will provide equitable areas for boys and men, and girls and women.
C. Facilities will provide for use by students, staff faculty and family of the school community.
D. Existing facilities will be programmed for use.
E. Facility expansion possibilities will be provided for in the planning.
F. Outdoor facilities should be located adjacent to the indoor facilities.
G. Writers of *The Program* will address themselves to the administrative and staff needs.

Part III. Trends Which Affect Planning:

A. A re-emphasis of physical education for the handicapped.
B. The club sports movement.
C. The Community Education, or "Lighted School", movement.
D. The surge of new non-competitive activities being added to the curriculum.
E. Expanding intramural and athletic programs.
F. Sharing of certain facilities by boys and men and girls and women (athletic training rooms, and equipment rooms).
G. Coeducational physical education and co-recreation.
H. Emphasis on individual exercise programs.
I. The weight training movement.
J. Federal and state legislation (PL 94-142, PL 503)
K. Systems approach in design and construction.
L. New Products.

Part IV. Explanation of Current and Proposed Programming:

A. Instructional
B. Intramurals
C. Athletics
D. Club
E. Adapted
F. Community-School
G. Others
H. A priority listing of programs

Part V. Preliminary Data Relative to the Proposed New Facilities:

A. The existing indoor facilities square footage broken down by area (equipment storage, training room, etc.).
B. A priority listing for the proposed new indoor facilities.
C. The existing outdoor facilities broken down by area (football field, track, etc.).
D. A priority listing for the proposed new outdoor facilities.
E. The community facilities being used as resource or adjunct facility areas for present programs, (golf courses, trap range, rifle range, bowling alleys).

Part VI. Space Needs and Allocation in the Proposed New Facilities:

A. Main Gymnasium.
B. Spectator seating.
C. Lobby or concourse.
D. Administrative offices.
E. Faculty offices.
F. Conference rooms.
G. Laboratory - Classrooms.
H. Other considerations (wall clocks, acoustical treatment of certain areas, etc.).
I. Others

Part VII. Purposes and Uses of Auxiliary Space Areas:

A. Exercise - Therapy Area.
B. Multi-purpose Gym.

C. Golf Area
D. Archery Area
E. Wrestling Gym.
F. Main Dance Studio
G. Street-Shoe Usage Room.
H. Handball - Racquetball Courts.
I. Squash Courts
J. Others.

Part VIII. Service Facilities:

A. Locker Rooms.
B. Shower Rooms
C. Toweling areas.
D. Toilets for locker area.
E. Equipment and supply storage areas.
F. Custodial storage areas.
G. Athletic training rooms.
H. Laundry.

Part IX. Projected Use of Present Facilities:

Part X. Space Relationship. Relationship each has to others.

Part XI. Equipment list (all movable and fixed items identified in the document.)

Role of the Program Specialist

The program specialist is an individual who is actively engaged in a program as a teacher or a coach. He is the one who will use the facilities and consequently, is knowledgeable about the uses and problems of facilities and should be given opportunities for input into facility planning.

The chief contribution of the program specialists may well be the written specifications they help develop. These specifications, called *The Program,* serve to communicate ideas to the architect and central planning committee.

Program specialists do not design facilities. This is a function of architects and engineers. However, determining the number of teaching stations needed to serve the instructional, intramural, athletics, club, adapted and other programs should be a responsibility of the program specialists. Selections of materials such as hardwood maple floor and/or synthetic floors, lighting requirements, acoustical treatment, and maintenance problems are all legitimate concerns of the program specialist.

The objectives which the program specialist should achieve are:

- Commmunicate the school program purposes, need for facilities and facility plans to all appropriate persons and public whose understanding and support are vital to secure the needed facilities.
- Ascertain the various size of teams, classes, and groups which will use the facilities as well as requirements or official rules for sports and games.
- Explore the multiple-purpose uses which are made possible by the new or expanded facilities.
- Help establish a priority list of program needs.

For example: A staff agrees that tennis should be taught in the instructional program, introduced as an intramural activity and added as an interschool sport. If this is the top program priority, the building of a suitable teaching area would be the top facility priority.

- State trends which are relevant to facilities planning.

Synthetic surfaces, all weather tracks, coed athletic training rooms, coed classes, programs for the handicapped, total community use of school facilities and rapid development of sports clubs are some examples.

- Identify, study and recommend desired traffic patterns for various individuals and groups, including spectators, indoor and outdoor facilities.
- Identify, study, and recommend proper space relationships for various indoor and outdoor facilities.

Within the locker room complex, the laundry space, equipment storage space (in season and out of season), issue area, athletic training area, and sauna may be so arranged that coed use is feasible. Duplication of personnel and equipment can be avoided by dual usage.

- Point out errors of design, space relationship, traffic patterns, safety, supervision, isolation, accessibility, flexibility, departmentalization, validity, and aesthetics.
- Provide the architect and planning committee with examples of facilities that meet desired needs.

If the sites are too distant for visitation, slides or pictures may be taken as illustrations for the architect and planning committee. Point out areas that represent quality as well as those that represent minimal quantitative standards.

- Point out the special considerations necessary to allow the handicapped full use of the facilities.

Role of the Consultant

Until recently, the profession has given little attention to the area of facilities in the professional preparation of teachers, coaches and recreational specialists. As a consequence, when a facility project is undertaken, professionals frequently are ill prepared. Time does not permit acquisition of the necessary background. Additionally, the architectural firm assigned to the project may be designing its initial PERA facility. It becomes apparent that competent assistance is needed.

The consultant in physical education and athletic facility design is frequently a professional in the field who teaches a course in facilities planning. This individual is usually familiar with many of the recently constructed facilities in the country and is aware of the latest innovations in design, materials, and concepts.

The consultant can make a valuable contribution in a number of ways. He can suggest to the planning committee the names of successful architects and the location of examples of their work. He can assist the planning committee in developing alternatives and establishing priorities. The role as a knowledgeable expert from the outside enables the consultant to exert considerable influence in favor of the project.

An important contribution is liaison between the architect and the planning group, particularly when the architect has difficulty in relating with the professionals. There are times when each has difficulty in understanding the needs of the other. It is important for both parties to realize that the resultant facility must reflect the concerns of the other. The selection of the professional consultant may be one of the most significant steps toward constructing a functional facility.

Another source of consultant assistance is the commercial agency established specifically to assist school districts, colleges and universities and recreation departments with the

solutions to facility problems. These firms have the capabilities of providing complete consultant services, from program through construction. They will also provide any number of singular services such as: broad base data gathering, writing the educational specifications and assisting with acoustic, lighting or air handling problems.

Selecting the Architect

A building efficiently and comfortably designed can evolve only from a well-coordinated team effort. The team should consist of individuals well versed in the facts and realistic objectives. The architect is only one member of the team, and the earlier he can begin working with the planning team, the better.

Selecting the right architect is not a simple matter. Important considerations are knowledge, past experience, personality and ability to establish rapport. The clients should interview prospective architects, view their work, inspect buildings they have designed, and confer with other clients they have served. Ideally, the entire planning team should participate in the selection of an architect, asking questions to confirm the firm's competency and compatibility with their objectives.

A detailed description of educational specifications should be formulated and given to the architect. The specifications are stated in narrative form and include suggested dimensions, spaces needed in the facility, relationships in special features of the facility, and the purposes of the facility will also be included in the proposed budget. The primary purpose of the educational document is to describe to the architect in clear detail, every activity to be conducted in a proposed facility.

Because of the training, educations, and experience, the architect can be of great assistance to the client in each of the three stages of every building project — decision, design, and delivery. When selecting an architect, the basic considerations are as follows:

1. He should hold membership in the American Institute of Architects.
2. He must be licensed to practice in the state where the facility is to be erected.
3. He should have an excellent reputation in the field, be able to furnish references, and be able to show proof of completion of similar projects.
4. The firm should be in close proximity to the construction site so that no less than weekly visitations could be assured.
5. Superior supervision capabilities should be available through the firm.

There are three basic methods of selecting the architect. They are:

1. If a state-supported institution, the architect may be appointed by the State Building Commission.
2. The architect may be selected by a direct appointment.
3. If a private institution or public school system, the architect may be selected by comparison from a group of prospective architects.

After the selection of the architect, a contractual agreement will be completed and signed. This legally binding contract will be the official A I A document B 141 (a standard form of agreement between the client and architect).

Starting to Work

Once the architect is selected, the whole team can be assembled. The team should be representative but not so large as to be unwieldy. It should include the architect, the firm's designated associates and perhaps a consultant expert in the requirements of the problem at hand, along with the school or community team.

The first meetings are critical. A constructive pattern of positive accomplishments should be established. The planning team should outline specific and comprehensive program requirements, determine sizes, designate functions, and delineate operational patterns. Meetings should be scheduled regularly and the committee should follow agendas, and notes should be taken, kept, and reviewed.

The architect will develop and revise increasingly detailed drawings as the meetings progress. To insure steady progress, it is essential that the drawings be developed progressively, each with more detail than the last, without changing the basic concepts. The basic concept developed in preliminary drawings should be evaluated very carefully.

The professional duties the architect is involved in are:

Pre-design planning.
Schematic design.
Design development.
Construction documents.
Bidding.
Construction.

The architect's role during each of these phases are as follows:

Pre-design Planning

Serve as a member of the planning committee in the capacity of a consultant or adviser on the architectural possibilities and limitations.

Schematic Design.

With the assistance of the educational planners, translate the written program into a graphic representation of a building plan.

Analyze the relationship of spaces diagrammatically, taking into consideration access of various areas by students and the public.

Study the site, its topography, its relationship to the community and to traffic patterns; also, the availability of utilities.

Determine how the site might be developed.

Determine what types of buildings are most appropriate for the site and the program.

Review applicable codes and laws, and determine their effect on the design.

Make cost studies of the project.

Provide opportunities for thorough analysis and discussion of strengths and weaknesses of plans, and reach decisions with educational planners on how well the plan satisfies the requirements of the program.

Present the approved schematic design for approval.

Design Development

Develop the basic design.

Prepare sketches of elevations and models to establish the visual character of the project.

Specify building materials, mechanical and electrical systems.

Develop equipment and furniture arrangements to specifications.

Prepare a detailed cost estimate and final plans to the planning team and proper authorities for review and approval.

Construction Documents

Prepare complete working drawings and construction specifications for the project.

Review and update earlier cost estimates.

Bidding

Assist the client in obtaining bids and awarding contracts.

Determine with client how project will be bid and what contractors will be qualified to bid.

Answer questions for bidders and clarify any aspects of the construction documents.

Provide copies of specifications documents, and drawings for contractors, owners, and others who may need them.

Assist client in preparation of contract.

Contruction Phase

Call a meeting with contractor and representative of the client to outline the project and discuss operating procedure.

Issue bulletins and change orders to accomplish changes requested by client or required by field conditions.

Make periodic visits to site to monitor progress of work.

Issue the client certificates of payment.

Interpret requirements of the contract whenever questions are raised.

Reject work which fails to meet the requirements.

Establish the date of "Substantial Completion" and the date of "Final Completion".

Additional Services

There are a number of additional services the architect may perform as required or as requested by the client. These services require prior authorization from the client, and the architect is paid for them in addition to the basic fee. Some of these services are:

- Make measured drawings of existing construction when required for planning additions or alterations.
- Revise previously approved drawings, specifications, or other documents to accomplish changes not originally initiated by the architect.
- Prepare change orders and supporting data where the change in basic fee is not commensurate with the services required.
- Prepare documents for alternate bids requested by the client.
- Provide detailed estimates of construction costs.
- Provide consultation and professional services concerning replacement of work damaged by fire or other causes during construction.
- Provide interior design work or other services required in connection with selection of furniture or furnishings.
- Provide services as an expert court witness.

Follow Through

It is essential that drawings be understood. Often people have great difficulty interpreting drawings and are too embarrassed to ask for aid. Explanation should be thorough, even if they seem agonizingly basic. Three-dimensional models can help to increase comprehension of the relationship of wall heights to room volumes. Model furniture or miniature figures can contribute to appreciation of room sizes.

As the drawings progress and the total idea of the actual building develops, specific materials and finishes should be chosen. The committee should view either representative samples or actual installations of like materials.

The more each team member knows before actual construction begins, the fewer surprises and less potential for disappointment.

Planning Factors

The guiding principles associated with total planning are: Every community needs areas and facilities for physical education, athletic and recreational programs. These programs, which are essential to the well-being of all people, cannot be effective unless a wide variety of indoor and outdoor facilities is provided.

Every community requires a master plan based on a study of its needs. Preparation of this plan is the primary responsibility of established governmental and educational planning agencies. Provisions for a system of properties required for physical education and recreation must be included in the master plan.

The type, location, and size of essential areas and facilities must be related to the total community pattern. These conditions vary in residential areas of different types and densities and are affected by the location of thoroughfares, business and industrial districts, transportation lines, and other natural barriers.

Areas and facilities should be planned in relation to the social and economic characteristics of the community. The feasibility of providing specific programs in a particular locality is influenced by the interests and financial resources of its total population.

Areas and facilities should be planned with due regard for the full potential use of available physical resources. Plans for acquisition and development can be justified as economically sound only if they are related to an inventory of comparable resources in the community or region. Duplication of facilities and overlapping of services is thereby avoided, and a maximum return from expenditures for areas and facilities can be expected.

Areas and Facilities should accommodate programs that serve the interest and needs of all the people. Consideration should be given to the special needs of all ages and both sexes. Resulting programs should comprise a wide range of activities. In view of the increasing proportion of the population in the aged and retired group, special consideration of senior citizens needs is desirable. Facilities should also make it possible for handicapped citizens to participate in most aspects of physical education and recreational program.

Plans for areas and facilities must conform to state and local regulations and, as much as possible, to accepted standards and practice. Planning groups should become familiar with fire, building, electrical, sanitary and other pertinent codes and make sure their plans conform to them. Unnecessary expense may be incurred in making construction changes required to meet official approval.

Maximum flexibility of design is encouraged to accommodate future needs. There is a danger that this can be practiced to the point where it harms the primary mission of a new facility. For example, an ice facility can be made so flexible

that it fails to adequately support a hockey program. Spectators refuse to come because of inferior or inadequate seating, limited security, inadequate ticket area, or poor concession arrangements.

Cost of construction is only one important financial consideration. The operating and maintenance costs of a facility must be considered. It is possible to obtain the funds to construct the new facility and then discover that there is no way for the planning unit to obtain the needed funds to operate and maintain the new addition.

Close cooperation among all public and private agencies concerned with the development and operation of facilities designed for athletics, physical education, and recreation is of utmost importance. Cooperation involves not only school, park, recreation, and city planning agencies, but also redevelopment authorities and public and private housing agencies, among others. An interagency planning committee can be an effective means of achieving cooperative action.

All interested organizations, individuals, and groups should have an opportunity to share in the planning of areas and facilities intended for public use. Wide participation in the consideration of proposals requiring the expenditure of public funds for areas and facilities gives people an opportunity to express their desires and needs and helps assure their support of the projects and use of the areas and facilities.

Individuals who are qualified to give expert advice in planning facilities should act as advisors. School, park, and recreations department personnel can contribute materially to the determination of the features to be included and can offer valuable suggestions for their design and development. Individuals with professional training and technical competence, such as landscape architects, architects, engineers, sociologists, and professional staff can play major roles in overall planning.

An assigned architect may have a limited background in a specific PERA project. An architect usually feels confident to build any project. However, most PERA projects are unique and background in this area is often lacking. The PERA divisions should provide the architect with sources of information specific to these facilities and the names of specialists that can be used.

Available sources of property and funding should be explored, evaluated, and used when appropriate. Tax funds are a primary source, but large numbers of facilities have been acquired or built with gifts from individuals or organizations. Localities should take advantage of state and federal funds available for planning and for acquisition and improvement of school and recreation areas.

Widespread publicity, sound interpretation, and public discussion facilitate the implementation of facility plans. Appropriate authorities, community groups, and the public at-large need to be fully informed if acceptance and support are to be achieved.

Planning Units: Community and Schools

Publicly-owned facilities are principally under jurisdiction of two types of local authorities — school districts and departments of parks and recreation. Other public and quasi-public agencies provide such facilities as libraries and museums. Privately-owned facilities, such as churches, settlement houses, health clubs, tennis centers, athletic clubs and youth clubs also contribute to the public service.

Comprehensive programs and services require that indoor and outdoor areas and facilities of many kinds, shapes and sizes be available throughout the year. Each area and facility has a special function and serves specific uses. These areas and facilities are classified in this Guide according to function, and their sizes are determined by the nature of their services and the number of people to be served. Understanding of this classification is essential to effective planning.

The Neighborhood

The neighborhood is a residential area usually served by an elementary school. A typical neighborhood for planning purposes would be an area three-fourths of a mile to a mile square and containing about 6,000 to 8,000 people.

Population densities of neighborhoods vary from a few thousand to many thousands per square mile. There is also a wide variation in the number of children. Because most residents live within a short distance of the school or playground, they walk to it and tend to use it frequently, often for shorter periods than in the centers planned for a larger geographic unit.

The Community

The community is a section of a city, primarily a residential area. It usually represents the service area of a high school, contains a business center, and commonly constitutes a section of the city measuring two or three miles across. It can be thought of as a "community of neighborhoods" because it is usually composed of three to five neighborhoods.

The City or School District

The area designated as the city, town, borough, or village lends itself to the provision of areas and facilities for use by the entire population of the political subdivision. Major parks, golf courses, camps, museums, and botanical gardens, which cannot be provided in each neighborhood and community, are typical city-wide areas. In small localities comprising one community and a single high school, city-wide planning is comparable to planning for a single community as described above, although some facilities commonly provided in larger city-wide areas are included.

School districts vary widely in size and population, but district-wide school planning involves primarily neighborhoods and communities. Some of the large school districts provide district-wide facilities for an outdoor education-recreation complex, interscholastic activities, consolidated educational programs, and some type of post-high school center or community for day pupils.

Large Units

The county or the region, which is a geographic area that sometimes includes part of more than one county, is increasingly used as a unit for recreation planning. Many of these planning units are located close to a metropolitan area and include both the city and the surrounding region. Others are primarily rural in nature and are composed of unincorporated areas. Planning on a regional or district basis lends itself to the provision of extensive properties usable for family outings, winter and water sports, and other activities requiring large land and water areas.

The Park-School Concept

Before the various types of properties that are commonly included in comprehensive plans are described, the current

trend toward providing areas that serve for both education and public recreation deserved special mention.

The park-school as described in this Guide is the recommended type of major facility in the neighborhood or community for day-by-day use in organized programs of athletics, recreation, and physical education. It combines the neighborhood recreational area and the elementary school site; the community recreational area and the secondary school site.

The park-school is an example of cooperative action between school and municipal authorities. It involves a joint agreement as to the location, development, and use of properties to be designed for the school athletic and physical education program and for the recreation of both school and community groups. Since the park-school concept is based on the desirability and economy of dual use, it is important that plans be developed jointly by both school boards and municipal authorities responsible for park and recreational services.

In order to protect the interests of the cooperating authorities, and to assure the most effective application of the park-school plan, a formal agreement should be signed by both agencies specifying respective responsibility for the purchase, development, operation, maintenance, and the use of the facilities.

Although the park-school concept has won wide acceptance in recent years, separate school sites and municipal recreational areas are still being acquired in many communities. While one reason may be lack of knowledge of the concept, more frequently it is because the school or municipal authorities fail to recognize the advantages and economy of the plan or are unwilling to subordinate their prerogatives under a cooperative program.

Community Park-School

The community park-school is an area in which are located a junior or senior high school and a variety of recreational, physical education and athletic facilities designated for both school and community use. It should be centrally located in the community it is to serve and provide a parklike environment. If it contains a senior high school, it requires more acreage than if it is associated with an elementary or junior high school and its service radius is appreciably greater. Many of the people using such centers, especially those with a senior high school, reach them by automobile or public transport.

The function of this area is similar to that of the neighborhood park-school. While the neighborhood park-school contains an elementary school and serves primarily children, the community park-school contains a secondary school and served primarily young people and adults. The geographic area served by the community school is larger and needs more area in order to provide for interscholastic athletics, spectator space, and extensive parking.

Outdoor Education-Recreation Complex

A land area or a cluster of acreages suitable for more extensive outdoor education-recreation programs, owned by the school district, city, or township, is an important adjunct of the park-school. Such a complex should be located as near the city as possible, yet should include some of the following: a residence camp; extensive nature trails; primitive area for outpost camping and exploration; an outdoor skills and sports center; plots for forestry and wildlife management; and pioneer and modern farms.

The Community Room

The community room is probably most representative of the community park-school program in that it is designed specifically to meet community needs. The community room should be at least as large as a regular classroom. Kitchen facilities, including stove, refrigerator, cupboards, tables and chairs, help to make it an ideal meeting place for civic and social organizations. The community room may be used during the day for adult club meetings, or casual recreational activities. In the evening, it may be used for adult classes or as a meeting place for community groups. Frequently, the community council, made up of representatives of all groups in the neighborhood meets in the community room to discuss programs for the area served by the school.

The need for intelligent and cooperative planning by all agencies, especially school and municipal authorities, was never greater than at present. Cost of land acquisition, construction, development, operation, and maintenance, as well as efficiency in use, will depend heavily upon the degree of cooperative endeavor and farsightedness. Sights must be raised immeasurably if present and future needs are to be met. The time for careful, imaginative long-range planning is now...in fact, it was yesterday!

Planning Units for Colleges and Universities

The following includes the various components that may be involved in the planning of any college/university PERA facility. The degree of complexity varies according to the type of institution and scope of the project.

1. *Governing Board* This body will need to give the final approval for the project. Within the board, there may be two or three individuals responsible for checking on all building proposals. Members of the PERA division are likely to be called before this latter group.

2. *State Planning Division* If the college or university is state supported, there will usually be a planning division in the state capitol which becomes involved. They normally determine if the facility meets all the state codes. Prior to their involvement, there may be a state appropriation committee that will need to give the approval to the project before any further planning can be done.

3. *Institutional Policy Committee* In some institutions, this is a standing committee, existing for the purpose of planning specific educational programs. This often is composed of key administrators, a member of the governing board, faculty representing the various divisions within the institution, and students. Policy recommendations of this committee give direction to Plant development committees, the president, and the governing board.

4. *Institutional Plant Development Committee or Office.* In many institutions of higher learning, such an office may exist. Often-times, it consists of a

WHO IS INVOLVED IN THE PLANNING PROCESS

Planning Unit	College/ University	Elementary/ Secondary	Community/ Recreation
Governing Board	Board of Regents	School Board	City Council
State Planning Division	Coordinating Board	State Board of Education	Outdoor Recreation Planning Department
Institutional Policy Committee	Campus Space Committee	General Planning Committee	City Park & Recreation Board
Institutional Plant Development Committee/Office	Office of New Construction	Office of Facility Planning & Construction	Capital Improvement Planning Division
Office of Buildings and Grounds	Building Maintenance and Utilities	Office of Operation & Maintenance	Parks & Recreation Maintenance Division
Architectural Firm	Same	Same	Various Professional Consultants
Project Coordinator and Committee	Member from Office of New Construction	Member from Office of Facility Planning & Construction & Designated Specialists	Member from Capital Improvement Planning Division
PERA Plannning Committee	Director, College, School, Department; New Construction Committee	Director of Physical Education & Safety	Director, Parks and Recreation
Area Specialists	Sub-Committee Structure	Sub-Committee Structure	Sub-Committee Structure (Staff Planning Specialists)

vice president and one or two in-house architects. They will question ideas as to multiple uses, architectural blending, internal building principles and campus sources of energy. A person may be designated as project director for a campus-wide facility. The PERA planning committee will need to clear many ideas through this office.

5. *Office of Building and Grounds* The Superintendent of this office and/or a representative will often sit on/or with the planning committee or the architect. It is the responsibility of this office to see that the building codes are followed, maximum use is made of present energy sources, energy conservation is included in new facility plans and campus beautification is maintained.

6. *Architectural Firm* If the project is of any magnitude, the architectural firm will have its own team working on the project. This often includes the principle architect, and engineer, and related specialists. The planning committee will meet with the architectural firm as a whole or with individuals from the firm, as the need dictates.

7. *Project Coordinator and Committee* The coordinator of a PERA project may be a higher administrator, such as the vice president. More likely, it would be the dean or director of PERA, or it could be someone from the office of the physical plant. If it is a higher administrator, the individual would most likely come from the office responsible for institutional facility development, although conceivably it could be a member of the university's planning committee. Someone from the PERA division would be a member of the committee and serve as chairman of the PERA's planning committee. In many instances, PERA's personnel with a particular interest and expertise, may be asked to be on the committee.

8. *PERA Planning Committee* The academic discipline has a planning committee which works directly with the architect and is responsible for coordinating all plans, requests, or changes that transpire between the discipline and the architect. Normally, this committee will be headed by either the dean or director of the division, the athletic director, the physical education director, or the director of campus recreation. There will be a representative on the committee from each of the areas having a direct interest in the project.

9. *Area Specialists* Much of the detailed planning will be done by sub-committees that report directly to the PERA planning committee. These sub-committees should have one or more meetings with the architect so that he has a clear understanding of their requests. Different facilities will have different emphasis areas which will need special attention.

Too often the planning committee of the discipline,

together with the architect, will do all of the detail planning. They cannot be experts in all areas, and many refinements that a sub-committee can point out, get lost.

Students can add a positive dimension to most of the committees through their representation. The same is true of community organizations and agencies that may use the facility after its completion.

The accompanying chart suggests appropriate levels of planning units for the public school sector and community recreation commission analogous to college and university planning authority. Referring to the chart, the operational procedures and planning methods for each planning unit for the three areas (college/university, elementary/secondary schools and recreational facility) may differ widely. The basic function of the planning unit, regardless of the area, will be remarkably similar.

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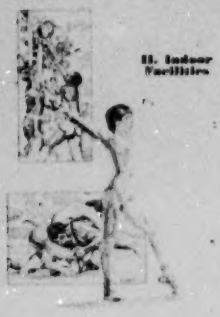
See annotated bibliography in Appendix for related articles

II. Indoor Facilities



Indoor Facilities

THIS CHAPTER CONTAINS information relative to athletic and physical education indoor facilities for elementary school, secondary school, and college/university levels.

Building features that are common to all structures are included so consideration will be given to the most efficient use of these facilities, while providing for the maximum comfort and safety of participants and spectators. Essential features such as site selection, traffic circulation, indoor surface materials, electrical systems and service, audio-visual services, color and aesthetics, mechanical systems, sanitary facilities, and security are covered in detail.

Site Selection

Program specialists, architects, engineers, and others should work together in the selection of a desirable site for any new construction. Some factors that must be considered in selecting a site are:

- Proximity to classrooms
- Pedestrian traffic patterns
- Motor traffic movement and parking space
- Soil conditions and drainage
- Availability of utilities
- Relationship to other health, physical education, recreation, and athletic facilities
- Proximity to housing

Physical education, athletic and recreation facilities are often the largest on campus. Space is essential to permit the architect to use creative design ideas. Avoid locating a facility on a site too small to allow for design options or for possible additions. Because of the size of these facilities, attention must be given to making them compatible with surrounding structures.

Ideally, a major indoor facility for physical education, athletics and recreation should be erected as close as possible to both the student living quarters and the center of the academic teaching area. Probably no other campus facilities will be used as much by as many students. If large spectator activities will be included in the facilities, the site must allow for auto access and parking.

Traffic Circulation

Building location is a most important consideration in traffic circulation and control. A careful study of the relationship of the proposed structure to student housing, academic buildings, and the community will provide valuable information relative to placement of primary and secondary entrances and exits.

The foremost purposes of planning for traffic circulation and control include: minimizing congestion in corridors, stairwells, locker rooms, and spectator areas; minimizing the disturbance of students and staff in offices, classrooms, and study rooms; providing for ease of building supervision, and separation of various units where necessary; enhancing efficient and safe movement; and providing for future building expansion.

Special circulation problems created by intramural, recreation, and spectator programs should be included in the traffic control study. The placement of service, activity, instructional, and spectator areas should provide for efficient means of supervising those using the facilities.

Space Relationships

The relationship of activity areas, instructional areas, and service areas to the placement and size of corridors, lobbies, stairs, and doors needs careful consideration. Spectator space should be separated from the swimming pool and pool deck areas, gymnasium floor, and other activity areas. Entrances to the seating area should be direct from the outdoors, or from corridors or foyers without requiring travel through locker rooms or across pool decks or gymnasiums. It is also important that traffic to and from the locker room not cross the gymnasium floor.

The individual components of the locker room areas should permit entrance to, and exit from, each area without

cross traffic in wet and dry areas. The location of toilet rooms in relation to the swimming pool and to outside facilities should be given careful consideration, especially with reference to public use.

Units within the building which require truck delivery service should be grouped to reduce the number of delivery points. Delivery of supplies should be planned so there is no traffic or delivery through locker rooms or across gymnasium floors. A loading dock is desirable. In multi-storied structures, elevators should be provided.

Corridors and Foyers

In large buildings, athletic and instructional units should be accessible from at least two passageways leading from the principal classroom areas to prevent traffic congestion during change of periods.

Provision needs to be made for heavy traffic from the dressing room or the locker suite to playfields. The designated corridor widths should be clear of all obstructions, including the swing of locker and room doors. All equipment, such as heating units, drinking fountains, fire extinguishers, and telephones, should be recessed. Each corridor should terminate at an exit, or stairway leading directly to a point of exit.

Public rooms, including gymnasiums used for large public groups should be designed with entrance foyers. The size of the foyer will depend on the seating capacity. The planning of this area should include consideration for ticket sales, public telephones, an information desk, and a cloak-room. The foyer should be accessible to public toilets for men and women. Often, it is advisable to provide cutoff gates so it will not be necessary to supervise the entire building when specific areas are not in use.

Stairways

Buildings of two or more stories should have no fewer than two stairways, located at the extremes. All stairways should be of fire-resistant construction, and all main stairways should lead directly to grade exits. Two-lane stairways are recommended, and they should have a clear width to conform with the local fire code.

Stairways should be divided into runs of not more than sixteen, nor less than three risers. Risers should not exceed 6½ inches, and treads should be at least 10½ inches measured from riser to riser. The rounded nosings of all treads and landings should have nonslip, flush surfaces. Abrupt overhanding nosing should not be used.

Circular or winding stairways should be avoided. Ramps are desirable to compensate for minor differences in levels in floors and to accommodate special needs of the handicapped. These ramps should have nonslip surfaces and should have a rise of not more than 1 to 12; 1 to 15, or 1 to 20 is preferable. Adequate stair aisles must be provided for all bleachers of more than three rows, whether movable or fixed.

Exits and Doors

Exits should be located so at least one exit, or stairway leading to an exit, will be within 100 feet of a doorway of every room designed for occupancy. Every floor should have at least two exits, remote from one another, and additional exits as prescribed by the National Fire Protection Association formula in the Building Exits Code. Exits should be located for convenience as well as safety. It is important that the number of exits and their locations be properly related to the seating capacity and the space in the gymnasium or swimming pool.

All doors should open outward, with the entire door swinging free of the door opening (side-hinges). Double exterior doors should be provided with a removable center mullion so that each door will operate independently and at least one such opening should be at least 36 inches wide. Every room should be provided with exits as prescribed by the Building Exits Code, and all outside doors should be equipped with panic hardware.

The doors to rooms where combustible material is kept should be constructed in accordance with Fire Underwriters' specifications. Exterior doors and all doors in damp areas, such as the swimming pool area, laundry rooms, shower rooms, and dressing locker suites, should be heavy-duty and moisture-resistant.

If exterior doors cannot be recessed, they should be protected against the weather by projections, overhangs, or soffits. Outside entrances should be provided with mud and dirt grates, or mats for cleaning the mud and dirt from shoes. One method which has proved satisfactory is the use of a grate-covered recess about six feet long and the width of the door opening, placed so persons entering the building must walk across it with both feet. Consideration should be given to the size of the openings in the grate to prevent accidents to persons wearing high-heeled shoes.

While minimum widths of corridors, stairways, and exits are determined by local codes, these areas should be considered in the light of maximum use of the building's facilities. Stairways and exits are most important in preventing traffic congestion, and should, in most cases, be wider than code requirements.

Teaching Stations

The unit of primary importance is the room or space where teaching occurs. All other parts of the school plant are, in a real sense, secondary. In physical education, therefore, the determination of the number and character of the teaching stations is basic to the planning process.

The term "teaching station" is used to identify any room or space where one teacher can instruct or supervise the learning experience of a class or group of students. For instance, a gymnasium would constitute a teaching station or, if divided, it could provide two or more teaching stations. Swimming pools, auxiliary physical education teaching stations, and rhythm rooms are examples of other kinds of teaching stations. The number of students accommodated by a teaching station is controlled by the nature of the specific activity as well as the size of the facility.

Institutions will vary as to the timing of peak load and consequently, as to when the required number of teaching stations is needed. Colleges and universities with a large professional preparation program and/or a required program for the general student body will usually have the greatest need during the regular instructional hours. Other schools may find the greatest need for different teaching stations during the after-school hours when athletic teams are practicing, or when an extensive intramural program is in operation. Schools in a climate which has a long cold season will have a greater need for extensive indoor facilities.

The number of teaching stations required is dictated by enrollment, policies pertaining to instructional physical education, average class size, diversity of program, number of

periods in the school day, and other uses of the facilities. Folding partitions and dropnets can be effectively used for flexibility and to increase the number of teaching stations.

Planners should be aware that indoor facilities for physical education, athletics, and recreation are difficult and costly to expand at some future date. The ultimate enrollment potential should be researched by school planner. The anticipated enrollment five to ten years after completion of construction should serve as a basis for determining the required number of original teaching stations. Long-range planning is imperative to provide for the logical and most economical expansion. The initial design should make provisions for the anticipated construction.

Indoor Surface Materials

The selection of indoor surface materials becomes complicated because indoor facilities may be subject to hard usage and/or excessive moisture, and they must meet minimum standards in terms of acoustical and light-reflecting properties. Geographic location and the availability of certain surface materials are factors to be considered.

Figure 2 is a guide to suggested indoor surface materials.

Floors

At least three distinct types of floor surfacing are required in facilities described in this Guide. Floors in service areas such as locker rooms, shower rooms, toweling rooms, and toilet rooms require a surface impervious to moisture. In general, gymnasiums and other activity areas require either a hard wood or a resilient synthetic material. Classrooms,

Figure 1
Teaching stations for diverse sports are segregated by nets at a field house on the campus of Sinclair Community College in Dayton, Ohio.

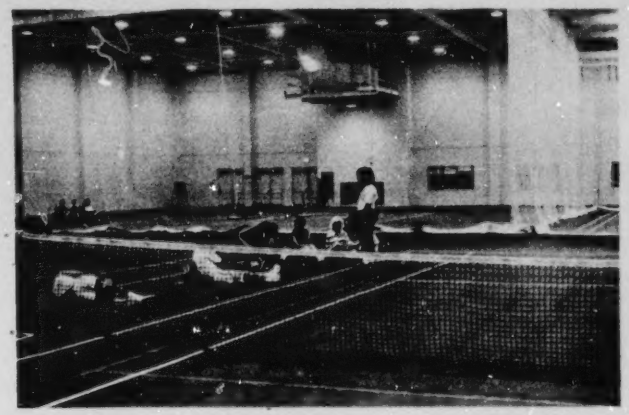


Figure 2
SUGGESTED INDOOR SURFACE MATERIALS

ROOMS	FLOORS							LOWER WALLS							UPPER WALLS					CEILINGS					
	Carpeting	Synthetics	Tile, asphalt, rubber, linoleum	Cement, abrasive & nonabrasive	Maple, hard	Terrazzo, abrasive	Tile, ceramic	Brick	Brick, glazed	Cinder Block	Concrete	Plaster	Tile, ceramic	Wood Panel	Moistureproof	Brick	Brick, glazed	Cinder Block	Plaster	Acoustic	Moisture-resistant	Concrete or Structure Tile	Plaster	Tile, acoustic	Moisture-resistant	
Apparatus Storage Room					1	2				1		2	1	C												
Classrooms				2		1						2		1		2				2	1			C	C	1	
Clubroom				2		1						2		1		2				2	1			C	C	1	
Corrective Room			1			2				2	1					2		2	2	1	2					1	
Custodial Supply Room					1			2																			
Dance Studio				2		1																		C	C	1	
Drying Room (equip.)					1		2	2	1	2	1	1						1		1							
Gymnasium			1			1				2	1					2		2	2	1	2	*		C	C	1	
Health-Service Unit				1		1						2		1		2				2	1					1	
Laundry Room					2				1	2	1	2	2			C	*						*			*	*
Locker Rooms			3		3		2	1		1		2	2	3	1		*	1		1	2				C	1	
Natatorium			2					1	2	1	3	2		1			*	2	2	1		*	*	C	C	1	*
Offices	1			3		2					2		1			1				2	1				*	1	
Recreation Room				2		1				2		2		1		1		2		1	2	*			C	1	
Shower Rooms					3		2	1		1				2	1		*	2	1	2	2		*			1	*
Special-activity Room				2		1					2			1		1		1		1	1				C	1	
Team Room	1				3		2	1	2	1	2	2	3	1			*	1		1	2				C	1	
Toilet Room					3		2	1		1	2	2	2	1			*	1		1	1					1	
Toweling-Drying Room					3		2	1		1			2	1			*	2	1	2	2		*			1	*

Note: The numbers in the Table indicate first, second, and third choices. "C" indicates the material as being contrary to good practice. An * indicates desirable quality.

corridors, offices, and like areas may be grouped together for common surfacing.

Special activity areas require different treatments. For example, a dance gymnasium that is used for instruction in modern dance should have a finished treatment which will allow the dancers to slide or glide across the floor. In other areas, such as basketball courts, the finish should be of a nonslip nature.

Flexibility, durability and cost are three criteria that have been instrumental in seeing synthetic surfaces challenge hard wood floors for installation in activity areas. Synthetics take the form of synthetic grass surfaces or as smooth or roughed nongrass surfaces. The most popular synthetic surfacing materials can be classed into two types: plasticized polyvinyl chlorides (PVC's) and polyurethanes. The PVC's are primarily prefabricated while the polyurethanes are either poured in place or produced in factory prefabricated sheets which are adhered down on the site. In general, the polyurethanes possess most of the desirable characteristics sought in a floor surface. The long term term differences in the maintenance costs between synthetics and wood seem to be negligible.

In general, classrooms, corridors, and offices have been satisfactorily surfaced with some type of tile, such as asphalt, vinyl, vinyl asbestos, rubber, or linoleum. Consideration should be given to the use of carpeting in offices, golf course locker rooms, and other appropriate areas.

Walls

In addition to segregating specific areas, walls should serve as barriers to sound, light, heat, and moisture. In selecting wall surfacing, considerations should be given to the acoustical properties of the material. In general, moisture-resistant walls with good acoustical properties are recommended. Most modern gymnasiums have smooth surfaces on the lower portion of the walls so they may be used as rebound surfaces. Rough-surfaced walls collect dirt easily and are difficult to clean. Recently, there has been a trend to color and murals, and design art to add aesthetic appeal.

In locker-rooms, shower-rooms, and toilet-rooms, where high humidity is often present, it is important to select wall surfacing that is moisture-resistant and has good acoustical properties. Walls serving as barriers between toilet-rooms, handball courts, squash courts, and other areas where noise is a problem should have a minimum of sound transmission.

Ceilings

Roof design, type of activity, and local building codes should determine the ceiling construction. Ceilings should be insulated to prevent condensation and should be painted to provide pleasing aesthetics and to enhance light reflection. Acoustical ceiling materials are desirable in instructional and activity areas. Dropped ceiling panels susceptible to damage by objects or individuals will require considerable maintenance

False ceilings with catwalks above them have been effectively designed to permit maintenance and repair of lighting and ventilating systems.

Sound Control and Acoustics

The sonic, or audible, environment is the most difficult phase of the total environment to balance and requires the services of an acoustical engineer. In each room, attention must be given to reverberation time. This is influenced by the absorption and reflection qualities of all surfaces within the room. Hard surfaces reflect sound and produce excessive unwanted reflection and reverberations. Thus, the space may be "noisy." Soft or absorbable surfaces turn the sound into another form of energy and can produce areas that are too "dead." Therefore, most areas must have some materials with sound-absorbing qualities in order to balance the sonic environment for good hearing conditions.

Sound Insulation

Unwanted sound, or noise, may be transmitted into the room by means of ventilating ducts, pipes, and spaces around pipe sleeves. The transmission of sound through ducts can be reduced by the use of baffles, or by lining the ducts with sound-absorbent, fire-resistant materials. The ducts may also be connected with canvas to interrupt the transmission through the metal in the ducts. Pipes can be covered with pipe covering, and spaces in the pipe sleeves can be filled.

Sound can also be transmitted through the walls, floors, and ceilings. This can be reduced to a desirable minimum by the proper structural design and materials. In the conventional wall construction, alternate studs can support the sides of the wall in such a manner that there is no through connection from on wall surface to another. This is sometimes known as double-wall construction. The space inside the walls can be filled with sound-absorbing material to further decrease the sound transmission. Sometimes three or four inches of sand inside the walls at the baseboard will cut down the transmission appreciably. Likewise, sound absorption blankets laid over the partitions in suspended ceiling construction can frequently reduce the sound from one room to another.

Machinery vibration or impact sounds can be reduced by use of the proper floor covering and/or by installing the machinery on floating or resilient mountings. "Sound locks," such as double walls or doors, are needed between noisy areas and adjoining quiet areas. Improper location of doors and windows can create noise problems.

It is imperative to pay attention to the acoustical treatment of all areas. Gymnasiums, swimming pools, and dressing-locker rooms are frequently neglected.

Materials for Acoustical Treatment

Care must be taken in the maintenance of acoustical materials. Oil paint reduces the sound-absorbent qualities of most materials. Surface treatment for different acoustical wmaterials will vary. The most commmon treatment of acoustical-fiber tile is a light brush coat of waterbase paint. Most acoustical materials lose their efficiency after several applications of paint.

Electrical Systems and Service

All electrical service, wiring, and connections should be installed in accordance with the requirements of the National Electric Code of the National Board of Fire Underwriters, and of state and local building codes and fire regulations.

The capacity of each individual electrical system should be determined accurately for obvious reasons of safety and economy. Full consideration should be given to present and future program plans when designing the electrical systems. The increasing use of electrically-operated equipment, higher standards of illumination, and special audiovisual equipment should be anticipated.

Illumination

In addition to the amount of light in any given area, the quality of light is of equal importance. Providing efficient illumination is complicated and challenging, and the services of an illuminating engineer are recommended in order to obtain maximum lighting efficiency. Gymnasiums, classrooms, corridors, and other specific areas have distinct and different lighting requirements. Planning for electric illumination requires that each area be considered relative to specific use. Figure 3 contains the levels of illumination recommended for specific indoor areas.

Measurements of Light

The footcandle is a measurement of light intensity at a given point. Light intensity, measured in footcandles, is one vital factor in eye comfort and seeing efficiency, but intensity must be considered in relation to the brightness balance of all light sources and reflective surfaces within the visual field.

The reflection factor is the percentage of light falling on a surface which is reflected by that surface. In order to maintain a brightness balance with a quantity and quality of light for good seeing, all surfaces within a room should be relatively light, with a matte rather than a glossy finish.

The footlambert is the product of the illumination in footcandles and the reflection factor of the surface. For example, forty footcandles striking a surface with a reflection factor of fifty percent would produce a brightness of twenty footlamberts (40 x .50 = 20). These brightnesses are necessary when computing brightness differences in order to achieve a balanced visual field.

Figure 3

Levels of Illumination Currently Recommended for Specific Indoor Areas

Area	Footcandles on Tasks
Adapted physical education gymnasium	50
Auditorium	
Assembly only	15
Exhibitions	30-50
Social activities	5-15
Classrooms	
Laboratories	100
Lecture rooms	
Audience area	70
Demonstration area	150
Study halls	70
Corridors and stairways	20
Dance studio	5-50[3]
Field houses	80
First-aid rooms	
General	50
Examining table	125
Gymnasiums	
Exhibitions	50[2]
General exercise and recreation	35
Dances	5-50[3]
Locker and shower rooms	30
Gymnastics	50
Archery	
Shooting tee	50
Target area	70
Badminton	50[2]
Basketball	80[2]
Deck tennis	50
Fencing	70[2]
Handball	70[2]
Paddle tennis	70[2]
Rifle range	
Point area	50
Target area	70
Rowing practice area	50
Squash	70[2]
Tennis	70[2]
Volleyball	50
Weight-exercise room	50
Wrestling and personal-defense room	50
Games room	70
Ice rink	100[3]
Library	
Study and notes	70
Ordinary reading	50-70
Lounges	
General	50
Reading books, magazines, newspapers	50-70
Offices	
Accounting, auditing, tabulating, bookkeeping, business-machine operation	150
Regular Office work, active filing, index references, mail sorting	100
Reading and transcribing handwriting in ink or medium pencil on good-quality paper, intermittent filing	70
Reading high-contrast or well-printed material not involving critical or prolonged seeing, conferring and interviewing	50
Parking areas	1
Storerooms	
Inactive	10
Active	
Rough bulky	15
Medium	30
Fine	60
Swimming pools	
General and overhead	50
Underwater[4]	
Toilets and washrooms	30

These standards have been developed by a panel of experts on facilities for health, physical education, and recreation after careful consideration of the activities involved. In all instances, the standards in this table are equal to, or exceed, the standards which have been recommended by the Illumination Engineering Society, American Institute of Architects, and National Council On Schoolhouse Construction.

[2]Care must be taken to achieve a brightness blance and to eliminate extremes of brightness and glare.

[3]Should be equipped with rheostats.

[4]Must be balanced with overhead lighting and should provide 100 lamp lumens per square foot of pool surface.

Courtesy of Illuminating Engineering Society of North America

34

Figure 4
Illumination Levels for Indoor Tennis Courts

Class of play	IES current recommended practice—footcandles (lux) maintained in service[a]	Minimum mounting height from floor		
		Direct	Indirect[c]	
Indoor		See note[b]	Between base lines and outside lines	Behind base lines
Recreational	20 (220)			
Club[d]	30 (320)	23 ft	16 ft	13 ft
Professional	50 (540)	(7 m)	(4.9 m)	(4 m)
Exhibitions	100 (1100)			

[a]Uniformity ratio of 2.0 to 1.0.
[b]Spacing (spacing-to-mounting height)—2.0 to 1.0 between rows.
[c]Spacing (spacing-to-distance from ceiling)—2.0 to 1.0 between luminaires in a row.
[d]May be increased for commercial considerations.

Important Lighting Considerations

In addition to the quantity and quality of light from the various kinds of lighting systems available, additional factors to consider in the selection of an electrical illumination system are maintenance, repair, replacement, and cleaning.

The ideal lighting fixture has both an indirect and a direct component, throwing surface light on the ceiling to give it about the same brightness as the lighting unit itself.

There is less need, however, to provide high-ceiling areas with direct-indirect fixtures. In gymnasiums, swimming pools and similar activity areas, an even distribution of light is required to permit the individual to see quickly and distinctly in any part of the room. It is advisable to provide supplementary lighting on such areas as those containing goals or targets, and to place dimmers on the lighting in spectator areas. Supplementary light sources should be shielded from the eyes of participants and spectators in order to provide the proper brightness balance.

Transparent, nonbreakable, plastic protective covers will protect lighting units in activity areas where balls may be thrown. Vapor-proof lighting units are recommended for damp areas, such as toilets, showers, the dressing-locker suite, and the swimming pool. Locker-room lights should be spaced to light the areas between lockers.

Incandescent, fluorescent, mercury-vapor and sodium-vapor lighting systems are most commonly used in gymnasium buildings. The incandescent light is instantaneous, burns without sound, and is not affected by the number of times the light is turned on or off. Incandescent lights and fixtures are considerably cheaper in initial cost, are easier to change, and the lamp, within limits, may be varied in size within a given fixture.

Incandescent fixtures, however, have excessively high spot brightness and give off considerable heat, a problem when high levels of illumination are necessary.

Fluorescent lamps have the advantage of long life and give at least two and one-half times the amount of light that incandescent lamps give for the same amount of current used. They are frequently used in old buildings to raise the illumination level without the installation of new wiring.

Mercury-vapor lighting is most expensive in terms of initial installation. The overall cost of mercury-vapor lighting, however, is cheaper than incandescent lighting. The primary objection to mercury-vapor lighting is the bluish color. However, when incandescent lighting is used in addition to mercury-vapor, a highly-satisfactory lighting system results.

Night lights which burn continually are recommended for gymnasiums, swimming pools, handball courts, squash courts, and other indoor activity areas. Lobbies, corridors, and some classrooms should also be equipped with night lights. These lights are extremely important for safety and security purposes and should have separate controls.

Provisions for outside lighting should be considered. Exit lights must follow the prescribed codes of the local community and the state. Electrically illuminated exit lights, clearly indicating the direction of exit to the exterior, should be provided: over all exit doors from gymnasiums, combined auditorium-gymnasiums, multipurpose rooms, and other rooms used for assembly purposes; over all exit doors from the building; and at the head and foot of exit stairways. All exit lighting should be on special circuits.

Emergency (white) lighting systems should be provided for exits (including exterior open spaces to which the exits lead) in gymnasiums, multipurpose rooms, and other places of assembly or large-group activity. This lighting should be on a special emergency circuit. All controls should be located so as to be under the supervision of authorized persons, and all other aspects of the installation should meet the specifications prescribed by the Underwriters Laboratories, the Building Exits Code, and state and local fire laws and regulations.

Fire-Alarm System

Electrical fire-alarm systems should be separate and distinct from all program-signal or other signal systems, and should be designed to permit operation from convenient locations in corridors and from areas of unusual fire hazard. All fire-alarm systems should meet the specifications prescribed by the Underwriters Laboratories and by state and local fire laws and regulations.

Program-Signal System

Gymnasium buildings can be wired for a signal system operated by a master clock or push buttons from the main administrative offices. Secondary controls may be placed in other administrative units of the facility.

Program signals should be independent of the fire-alarm system and should not be used as a fire-alarm system.

Program signals usually include: buzzers or chimes in the classrooms; bells in corridors, pool, gymnasiums, fields, and dressing-locker suites; and large gongs on the outside of the building. In many instances, signals placed strategically in

corridors rather than in individual classrooms are adequate. Electric clocks should be included in all indoor areas in the program-signal system.

Electrical Service Controls

The entrance for electrical service should be installed to insure the safety of the students and building personnel. When practicable, it should be located at the side or rear of the building, away from heavy-traffic or play areas.

Main service panels with main service switches, meters, and main light and power panels should be located so as to prevent entrance by anyone except those authorized.

Secondary control panels should be placed for the convenient use of individuals who open or close the facilities during hours of darkness or outside of regular hours. Electric lighting and power should be fully available to all athletic, physical education, and recreation facilities during hours when the main offices and classrooms may be closed.

The main distribution panel, all secondary panels and all circuits should be protected by automatic circuit breakers. A number of spare circuits should be provided in panels for future use. Secondary panels, located in corridors, halls, and similar places, should be of the flush-front type provided with locks.

Wiring for program-signal systems and communications should not be in the regular service conduits. Switches in instructional rooms should be arranged so that lights adjacent to the interior wall may be controlled independently of the lights adjacent to the exterior wall. Consideration should be given for placing light switches at a heighth convenient for wheelchair users.

Stairway and corridor lighting should be on separate circuits. Three-way switches should be provided at the foot and head of stairs, near each end of corridors, and near doorways of large classrooms, activity rooms, or gymnasiums. This will permit control of the lights from two or more points. Switches should be located on the open side of entrances to all spaces in the building. Switches also should be provided in projection booths to control the lights in the rooms used for spectator activities. Remote control switches should have pilot lights.

Telephones

In addition to telephones provided in offices and some classrooms, independent telephone service should be provided to the gymnasium, swimming pool, health unit, or other facilities to be used when the main offices are closed. Where several extensions are necessary, a central exchange system may be used. The local telephone company should be consulted in order to provide a satisfactory and economical telephone system.

One or more pay telephones should be installed for public use in convenient areas, such as in the gymnasium foyer or near activity areas which serve participants and spectators.

Public Address System

Built-in public address systems are considered a basic service for indoor and outdoor facilities which accommodate sports events, demonstrations, or similar activities. Special consideration should be given to outdoor areas where large groups gather. Sound systems should be designed by qualified engineers.

Public address systems should be designed for flexible use. Microphone inputs and secondary control panels should be located according to the variety of anticipated uses. A built-in system for a large gymnasium or similar area should be able to accommodate such needs as these:

- Announcements and description of athletic contests and other events, either from the main floor or from a press booth
- Amplification of vocal and instrumental music or directions for group activity
- Instructions or announcements in connection with large group social recreation activities, demonstrations, contests, or meetings
- Addresses or panel discussions at meetings
- Directions for building control
- Amplification for underwater speakers that can be tied in with the pool public address system for synchronized swimming and other swimming instruction or contests

Intercommunication System

Means of communication should be provided not only between the main administrative office and the other facilities, but also between individual units of these facilities. Special consideration should be given to the need to communicate with instructors who have groups on outdoor areas. Secondary control panels and microphone-input equipment should be carefully planned to permit programs or other communication to originate in places such as the swimming pool or gymnasium.

The central sound system should include provision for both radio and television reception and transmission. Appropriate space and special conduits should be provided to accommodate television installation at a later time.

Audiovisual Service

Many of the units, especially classrooms, health rooms, gymnasiums, and swimming pools, will require electrical service for projectors, tape recorders, record players, portable public-address equipment, and radio and television. The specific needs for such service should be determined before wiring and conduit layouts are designed. It is imperative to install ample conduits and duplex outlets to provide for the increasing use of audiovisual aids. Planners should consult program specialists and professional literature in the fields of health, physical education, and recreations, and, in addition, should consult those qualified to recommend installation of audiovisual equipment.

Light switches should be placed, when possible, near the location where the audiovisual equipment will be used. Power for audiovisual aids, however, should be furnished through outlets independent of the light switches. In classrooms, outlets for audiovisual equipment should be installed at both the front and rear of the room.

Steel construction and electrical equipment often impede radio and television reception through individual built-in antennas. Therefore, when there is anticipated use of television or radio receivers in the various units of the building, connections to a central antenna system or communications center should be provided.

In audiovisual rooms, it is desirable to run an appropriately sized conduit, with polarized outlets at each end, from one end of the room to the other to carry the sound cable. A master television antenna should be considered. Electrical service for lights and special audiovisual effects also should

be considered for bulletin boards, display cases, the gymnasium foyer, and other similar locations.

New construction should anticipate provision for the transmission of radio and television programs of several types:

- Public service broadcasts through commercial or educational radio and television outlets, including athletic events, demonstrations, study courses, or other similar instructional, interpretive, or entertainment features.
- Closed-circuit instructional programs transmitted to other units of sections of the same building, or to other buildings on the campus.
- Closed-circuit instructional programs transmitted to other schools through educational radio and television facilities. Planners should give imaginative consideration to providing facilities to accommodate radio and television offerings in their present programs or those for the future.

Larger institutions may obtain guidance from the following campus services: instructional resources center, television production center, or audiovisual services. Personnel associated with such centers are increasingly alert to the needs and problems related to developing instructional television systems.

Smaller institutions without such services should consult the latest edition of *Educational Facilities with New Media.* This source contains a thorough discussion of policy-making, facilities design, and technical requirements.

Services for Appliances and Other Electrical Equipment

There are many needs for electrical wiring and connections which require careful analysis and planning. The following are illustrative;

- Basic construction: motors to operate folding partitions; blowers for heaters and ventilating ducts; exhaust fans in gymnasium ceilings or walls.
- Custodial and maintenance services: receptacles for floor cleaning equipment and power tools.
- Dressing locker rooms: wiring for hair and hand driers and electric shavers.
- Lounges, kitchenettes, snack bars, and concessions: outlets for refrigerators, water or soft drink coolers, electric stoves, blenders, mixers, coffee urns, and hot plates.
- Office suites: wiring for individual air-conditioners, business machines, floor fans, and other mechanical and electrical equipment.
- Laundry rooms: wiring for washers, driers, and ironers.
- Pools: provision for underwater vacuum cleaners, pumps, and special lighting.
- Gymnasiums: provision for special lighting effects, spot lights, and rheostats or controls to lower the illumination for certain activities.
- Health suites: receptables and provision for audiometers vision-testing equipment, floor fans, and air-conditioning units.

Figure 5 summarizes some of the needs for outlets and special wiring and connections.

Climate Control

The engineering design of heating, air-conditioning, and ventilating systems should be based on the technical data and procedures of the American Society of Heating and Ventilating Engineers. The selection of the type of heating, air-conditioning, and ventilating systems should be made with special consideration for economy of operation, flexibility of control, quietness of operation, and capacity to provide desirable thermal conditions. The design and location of all climate control equipment should provide for possible future additions.

Since the number of occupants in any given area of the building will vary, special consideration should be given to providing variable controls to supply the proper amount of fresh air and total circulation for maximum occupancy in any one area. Specially designed equipment and controls are necessary to insure that climate control in some major areas can be regulated and operated independently of the rest of the facility.

All three mechanical systems — heating, ventilating, and air-conditioning — are interrelated and should be planned together. The services of a competent mechanical engineer should be obtained, not only for design, but also for making inspections during construction and for giving operating instructions to the service department.

Some problems involved in the installation of heating, ventilating, and air-conditioning systems include:

- Maintaining a minimum noise level
- Maintaining separate temperature control for laboratory areas
- Insulating all steam, hot water and cold water pipes and marking them with a color code
- Exhausting dry air through the locker rooms and damp air from the shower room to the outside
- Providing a minimum of four changes of air per hour without drafts
- Installing locking type thermostats in all areas, with guards wherever they may be subject to damage
- Placing the thermostats for highest efficiency
- Zoning the areas for night and recreational use
- Eliminating drafts on spectators and participants

The geographical location of the proposed facility will dictate to some extent the type of climate control equipment selected for installation. Mechanical ventilation is preferred over open windows. Air-conditioning has been strongly recommended for southern climates, but year-round use of facilities makes air-conditioning a desirable building feature in other areas. Special rooms such as locker rooms, shower rooms, swimming pools, and steam rooms need special consideration for moisture and humidity control.

(The rising cost of energy also is an important operational consideration.)

Security

The athletic and physical education complex presents a unique security problem. The facilities and the programs attract large numbers of individuals who move at all times during the day and week, and through many areas in different directions.

It is reasonable to believe that all students and visitors who come to the building have a distinct purpose in coming and should be welcome. This is the type of building which people enter through many outside doors and disperse to offices, classrooms, dressing rooms, activity areas and spectator galleries. There should be some plan for pedestrian control and for the handling of visitors.

Security is accomplished in two ways:

- Constructing the facilities according to a plan which allows for maximum security

Figure 5
*Suggested Needs for Electrical Service**

FACILITY	SPECIAL WIRING & CONNECTIONS FOR															
	Communications															
	Receiving			Sending												
	Air-Conditioner (220 volts)	Central Intercom	Radio	Television	Central Intercom	Radio	Television	Display Cases, Bulletin Boards	Exit Lights	Motors, Blowers, Exhaust Fans	Public-address System	Scoreboard	Stove or Grill, Electric (220 volts)	Telephone	Washer, Drier, Ironer, Dishwasher	Rheostat, Dimmers
Adapted Physical Education Room		X	X							X						
Administration — Office Suite	D	X	X	D	X			X							X	
Archery Range — Indoor		X														
Audiovisual Room	X	X	X	X	X	X	X									
Auditorium	D	X	X	X	X	X	X		X	X	X					
Bowling Alleys		X	X					X	E	X						
Classrooms		X	X													
Clubrooms	D	X	X	X				X	E							
Corridors									E						D	
Custodial Rooms		X													X	
Dressing-Locker Rooms		X								X						
Equipment Rooms		X	X													
Faculty-Staff Rooms	D	X	X	X											D	
First-aid Room	D	X	X												X	
Foyer		X						X	X						X	
Game Room (Ping-Pong, Billiards)	D	X	X	X				X	E							
Gymnasium & Field House		X	X	X	X	X	X		X	X	X	X	X			
Handball Courts																
Health-Instruction Laboratory	D	X	X	X		X	X	X								
Health-Service Suite	X	X	X	D	X										X	
Kitchen or Kitchenette											X			X		X
Laundry		X									X					X
Library	X	X			X			X			X				X	
Lounge, Social Room, or All-purpose Room	D	X	X	X				X							X	
Multi-purpose Room	D	X	X	X	X	X	X			X	X	X				
Outside Areas		X	X		X	X	X					X	X			
Rifle Range — Indoor		X														
Skating Rink (Ice or Roller)	D		X			D	D	X		X	X	X				X
Snack Bars — Refreshment Stands								D		E	X			X		
Stadium		X	X		X	X	X	X		X		X	X		X	
Staff Office & Service Facilities	D	X	X												X	
Storage Rooms (In-season)																
Storage Rooms (Out-of-season)																
Swimming Pool		X	X		X	X	X	D		E	X	X	D		X	X
Toilet and Shower Room											X					

Legend:
X - This kind of service or equipment is either necessary or often found in the facility.
D - Desirable or sometimes found in the facility.
E - Exit lights needed if opening to exterior or if spectators or large groups assemble in the facility.
* - Duplex outlets should be installed in all rooms in anticipation of present and future needs.

- Adopting an administrative plan for the direction and control of all persons using the building

The physical layout will facilitate security but will not guarantee it. A good administrative plan will help. However, a good administrative plan cannot completely accomplish effective security if the physical layout does not lend itself to the attainment of such security.

Security Features of Construction

Entrance doors constitute the first barriers against illegal intrusion. Open and descending stairways, walled entries, and deep-set entrances should be avoided. The points of entrance to buildings should be well lighted from dusk until dawn. The corners of the buildings should have floodlights which light the face of the structure. So-called "vandal lights" should be installed and protected to make them vandalproof.

Corridors which are continuous and straight, providing unbroken vision, add qualities of safety and security to the building, its contents, and its users. Corridors are best lined up with entrance doors, providing a commanding view of the doorway from the corridor, and of the corridor from the entrance door. There should be an attempt to avoid angular corridors, and to eliminate niches or cubbyholes.

The use of night lighting within the building and at its entrances will assist in protection against vandalism and other forms of undesirable conduct. Night lighting will require separate wiring and switches in order to maintain a desirable amount of illumination. Switches for such lighting should be key-controlled to prevent their use by unauthorized individuals. A building chart for day and night "on" and "off" lights should be developed. There should be additional directions for "on" and "off" at every switch, and such directions should be changed according to need. A key-station system for night-watch checking is desirable.

Security of the Building

Securing the building and its component rooms against illegal entry is the first and most logical consideration in terms of building protection. Good door framing, substantial doors, and heavy-duty hardware and locks hold up against wear and abuse. In their long life and securing qualities, they constitute a reasonable investment. In reducing replacement costs for materials and labor, the installation of good hardware is an economy in the long run. In reducing loss by breakage and theft, the additional security factor of quality hardware should never be overlooked at any cost.

A lock-and-key system, developed with the help of experts in the field of building administration, will usually result in a plan which considers some of the following features:

- A building master plan, including a lock-and-key system
- Lock-tumbler adjustments so that an area may have its own control and authorization
- Area division (vertical division) by responsibility or usage for key assignment; or "level" division (horizontal division) for key assignment; or a combination of both vertical and horizontal divisions
- A policy of not lending keys is recommended. The person to whom the key is assigned signs a pledge for no lending. The keys for the facililties should be identified by a distinguishing mark, and a policy should be established with key duplicators in the area that they will refuse to duplicate keys carrying such identifying marks
- An annunciator system in which outside or other doors of importance, such as swimming pool doors, may be connected to an electrically-controlled system. Any door can be connected in or out of the annunciator by a lock-controlled switch at the door, or a switch at the annunciator. Thus, a door tampered with or illegally opened after the annunciator is set for the "on" position will direct a warning signal. The annunciator may be developed to work by a light on a control box, the sound at a control box, an alarm sound of general broadcast in the building, or an alarm system with signals directed to the campus security office. The nature of the annunciator response should be determined by whether it is wished to quietly apprehend unauthorized persons, or if it is desired to deter them or frighten them away.

Security of Participants

Security and safety suggestions related to the use of specific facilities ordinarily found in a gymnasium structure include these:

- All swimming pool doors are to be locked unless unlocked by a person authorized to do so. When a door is unlocked for a purpose, the individual unlocking the door is responsible for the accomplishment of that purpose. Outdoor and some indoor pools may be connected with a sonar detection system or a sound amplification system which will announce illegal use or entry. The signal can go to one or several strategic control points. Swimming pools should normally be keyed differently than other areas in the structure.
- In a gymnastics gynmasium, or where there are related gymnastic activities, the room, or certain pieces of equipment, such as trampolines, must be locked except when an instructor is directly in charge. Providing storage areas sufficiently large to store all equipment for this activity is recommended. If possible, a separate room, secure from students and faculty, is most desirable.
- In viewing balconies, stairs should have handrails and lights at the sides, or luminous reflectorizing material on the edges. Bleacher seats should have aisles and exits to allow rapid clearing other than to the playing floor.
- Activity room floors should be free of objects or floor plates which set up above the floor level.
- Shower room and dressing room floors should be kept free of objects and obstructions which may cause foot injury.
- Shower rooms should be equipped with towel bars to aid in safety of those individuals using the facility. Hot water available through shower heads should have a maximum temperature of 120°F.
- Areas for vigorous activity, where combatives or competitive sports are engaged in should have floor and/or wall covering to protect the participants. No specifications of classifications are given here, but every consideration is urged and every precaution should be taken.
- Doors to steam rooms and dry-heat rooms must be locked from the outside when the room is unsupervised. The door should have an instruction plate by the door lock, bearing directions to those who have a key to unlock the door. Steam room controls should be set not to exceed a maximum room temperature of 130°F. This control should be tamperproof. The steam room should have a bar latch of the panic type (noncorrosive hardware) to make exit readily possible under any conditions, even if the door should be locked from the outside.

Dressing room entrances should be away from the main traffic and in the area where only participants go to change

clothes. Toilet rooms should be away from direct view of the lobby, and yet be in service corridors rather than in isolated parts of the building.

Stairs should be well lighted. In some cases, the edges of stairs should be marked. Objects in the building which may need to be identified for safety or position may need to be color coded or marked in some manner. In basement passageways and around motors and equipment, it is important to mark corners, low pipes or beams, and safety zone areas. On main floors, it is desirable to mark fire alarms and extinguishers, some traffic lanes, and first-aid boxes, and to indicate service and toilet areas with their appropriate service designations by door labeling or signs at door top height. Designation of objects can be accomplished by painting the objects or zones according to a color code.

Planning for Specific Programs

The task of the planner is to ascertain the indoor space requirements of the school and the community for athletics, physical education and recreation and to translate their needs into the number, size, type, and location of facilities.

The planner should give attention to the following general concepts:

The locker, shower, and drying room area should be planned for the safety, maximal use of space, comfort, traffic flow, security and the convenience of its users.

The involvement of all men and women staff members who will be using the areas is important. The development of a well-designed priority list should be established to see that the areas needed most will not be eliminated or expensive extras added by a sudden impulse or strong lobby from a special interest group.

To provide adequate variety in the physical education curriculum, it may be necessary to plan more than a gymnasium. In a school for kindergarten through third grade only, a room smaller than a gymnasium may be used, unless it is also a neighborhood center for adults.

While a single facility may meet the instructional needs of the physical education program, additional space will be necessary if all students are to be given an opportunity to participate in an intramural and/or interscholastic program.

To expand the basic program in physical education, it is desirable to have such additional special facilities as bowling alleys, swimming pools, and archery and rifle ranges. It may be possible for the school to obtain some of these facilities through the cooperative use of existing or proposed facilities owned and administered by some other agency.

As planning for recreation is considered, the entire school plant becomes a potential space resource, and all units should be scrutinized and planned with recreational adaptability in mind.

Elementary School Indoor Activity Areas

The elementary school physical education program centers around the teaching of fundamental movement patterns, rhythmics or dance, games and sports, gymnastic activities, combatives, self-testing activities, and aquatics. The design and scope of physical education facilities should reflect the activities included in the elementary physical education curriculum.

A major consideration fundamental to the planning of an elementary school indoor activity area is the anticipated use by the community. Future years are expected to see more and more community use of these facilities.

Several of the standard planning principles apply particularly to the elementary facility. Such planning principles would include establishing priority use for the facility, giving basic consideration to the primary age group using the facility, allowing for use by physically and mentally impaired children, designing for the participants ahead of the spectators, and remembering considerations for maintenance of the facilities.

Location

Elementary schools are often more compact than other schools and it is desirable to have the activity area apart from the classrooms to reduce noise disturbance. With the increasing use of such facilities by the community, consideration must be given to accessibility from the parking areas. In addition, it should be adjacent to the outdoor play fields. This allows for easier storage of equipment and increases the efficiency of the area to be used as a neighborhood playground in the summer months.

Teaching Stations for Physical Education

Elementary school physical education classes may be organized by a number of methods. The average class size is usually based on the number of pupils in the classroom unit. Because of differences in pupil maturation, physical education periods generally vary from 20 minutes for kindergarten and first grade to 45 minutes for fifth and sixth grades, with the school average (for computation purposes) being 30 minutes per class.

The formula for computing the number of teaching stations needed for physical education in an elementary school is as follows:

Minimum Number of Teaching Stations = Number of Classrooms of Students x Number of Physical Education periods per week per class (Total number of Physical Education Class Periods in a school week)

Example:

- Number of classrooms of students — school contains grades K to 6, three classrooms for each grade level, or a total of 21 classroom units.
- Number of physical education periods per week per class — one period per class for physical education each school day during the week equals five periods per week.
- Total number of physical education class periods in school week. There are five instructional hours in the school day, and the length of physical education period is 30 minutes. Thus, a total of ten 30-minute periods each school day may be scheduled for physical education, or a total of 50 periods for the five-day school week.

The teaching station needs would be calculated as follows:

Minimum number of teaching stations equals 21 classroom units times 5 periods per day, 50 periods per week, equals 105 divided by 50 equals 2.1.

In the above situation, if one classroom section was dropped each week (bringing the total to 20) then the need would be 2.0 teaching stations. Therefore, requiring physical education five periods per week in the school used as example, would necessitate employing two physical education teachers each hour of the day.

In many school systems the above situation would be too idealistic. More likely only one physical education instructor would be available (either a specialist, or the classroom teacher, or a paraprofessional in collaboration with one of the other two). This would then drop the number of sessions per

week for each classroom unit from five to an average of 2.5. One teaching station would handle this setup.

If only one teaching station can be provided in the elementary school then preferably it would be a gymnasium. Despite the fact that some other type of auxiliary station might prove superior for instruction in the lower grades, the elementary gymnasium remains the preferred facility because of its heavy use by both the upper grades and the community. If the school system and the community were in need of an indoor swimming pool, this would be the choice for a second teaching station.

The next choice is an auxiliary teaching station, sometimes called a playroom. Particularly when heavy community use is anticipated, another alternative is to build a larger gymnasium and allow for dividing it by a folding partition or dropdown nets. Such a setup would provide four possible teaching stations, two on each side of the divider. This area would also allow for two basketball intramural courts, one basketball inter-school court, three volleyball courts, six badminton courts, and four multipurpose game circles.

Multipurpose rooms and cafeteria-gymnasium combinations have been found to be most impractical for physical education, especially from the standpoint of scheduling. Self-contained classrooms are restrictive in the types of activities that can be offered and have an additional disadvantage. Furniture must be moved whenever activity takes place.

If used, such classrooms must provide an unobstructed area of 450 sq. ft., be of a nonskid surface, have no dangerous projections, and ideally have direct access to an adjoining terrace, part of which should be roofed for protection against rain. These self-contained classrooms would only be used in the lower grades.

The Gymnasium

In planning the elementary school gymnasium, a minimum of 100 square feet per pupil and a total of at least 4,000 square feet is recommended. Spectator seating (if provided) and storage rooms require additional space. Many of the general considerations recommended for secondary school gymnasiums also apply to elementary school facilities.

The specific dimensions of the gymnasium should provide for a basketball court of 42 by 74 feet, with a minimum safety space of six feet around the perimeter. An area of 54 by 90 feet (4,860 square feet) would be adequate. The ceiling should be at least 22 feet high. This space is adequate for activities normally included in the elementary school program and will serve the community recreational program. The gymnasium will be of a larger size if the decision is made to use it as a multiple teaching facility and include a folding partition or dropnets as part of the design.

Auxiliary Teaching Stations

If a second indoor physical education teaching area is built it should be either a swimming pool or an auxiliary instruction room, sometimes called a playroom. Swimming pools are discussed elsewhere in this text. The auxiliary teaching station is most practical when the main gymnasium cannot fulfill all of the school's needs for teaching stations.

At least 60 square feet per primary pupil, with a total minimum of 1,800 square feet of space, is suggested for this unit. A ceiling height of 18 feet in the clear is preferred, although lower ceilings may be used. One wall should be free of obstruction to be used for target and ball games or throwing practice. A smooth masonry wall will provide an adequate rebounding surface. If included, windows should be of breakproof glass or be protected by a shield or grill and located high enough as not to restrict activities.

The auxiliary unit should be planned to accommodate limited apparatus and tumbling activities, games of low organization, rhythmic activities, movement exploration, and other activities for the primary grades. Often a 25' circle for circle games is located at one end of this room, allowing for permanent or semi-permanent equipment at the other end. The equipment could include such items as climbing ropes and poles, ladders, mats, stall bars, rings, large wooden boxes, horizontal bars, and peg boards. These should be located so as not to interfere with other activities or so they may be easily moved out of the way. A storage room for equipment and supplies should be included. A section of wall can be equipped with hangers for mat storage.

Electrical outlets are required for the use of sound equipment. This room will, for the most part, be used by the lower grades and should be accessible to those classrooms. If the area is to serve the after-school recreational program for pupils or community groups, toilet facilities should be accessible.

Surfaces

The best floor surface to use may depend upon the number of different teaching areas. The main gymnasium area should have either a hard wood or synthetic surface. Wood, preferably maple, is an excellent all-around surface, although lacking the durability and flexibility that might be demanded by extensive community use of the facility. The new synthetic surfaces have proven excellent for all normal game-type activities and also can better accommodate events that put additional stress on the floor, such as setting up chairs, tables, booths, etc. In an auxiliary teaching station, carpeting is often used. It eliminates the use of certain small wheeled equipment. Tile is not recommended as a play surface.

A special consideration is the structure and material used in the ceilings. Ceilings should be durable and resistant to puncturing.

Storage

Storage rooms are needed for each of the different instructional areas. The room adjoining the gymnasium should be at least 200 to 300 square feet and should be directly accessible from the gymnasium floor through a double door without a threshold. For safety reasons, the doors should open inward and be provided with locks. Consideration must be given to community use of the facility and the storage of related equipment. Ideally, there would be a separate storage room for each of the programs. The storage areas should have bins, shelves, racks, and hangers for the best utilization of space and the proper care of equipment and supplies. Space to store out-of-season equipment is essential to prevent loss or misplacement between seasons. An outside entrance assists in the handling of equipment that is used outdoors and/or in connection with a summer playground program.

Shower and Dressing Rooms

Although it has been standard practice not to include shower, locker and dressing room facilities in the elementary school, such facilities are essential if the gymnasium is to be used for intramural-interschool competition, and community usage. The size, number of lockers, showers and toilet facilities will be dependent on the extent of usage. If

swimming pools are added as part of the school-community complex, such facilities are a must. Provision for outdoor restrooms is desirable if the general public is involved.

Programming for Construction of a Playroom

Use of Playroom. This area should be suitable for preschool and for grades K-3 for fundamental movement activities, including creative games and rhythms, relays, stunts, climbing and hanging activities.

Size. The area should be a rectangle measuring approximately 50 by 40 feet, providing 2,000 square feet of space.

Ceiling. The ceiling should be acoustically treated, 14 to 18 feet high (all beams and supports above the minimum height), with suitable fixtures attached to the beams to support hanging equipment.

Walls. Walls below 10 feet should be free from obstruction. A smooth concrete block sealed with epoxy paint works well. Above 10 feet should also be free of obstruction, but made of acoustic or slotted concrete block. A wall free from obstruction will provide practice areas for such activities as kicking, striking and throwing, and a space for the placement of targets and use of visual aids.

Floors. A hardwood maple or synthetic surface of good quality provide the best floor for general activity use. Both have advantages and disadvantages. The decision should be based on how the floor is to be used. Careful consideration should also be given to the location of lines and the installation of equipment.

Lighting. Fluorescent lighting should supply 50 footcandles on the floor, and a switch should be installed at each door. Light fixtures should be guarded to prevent breakage.

Windows. If used at all, windows should be placed on only one side of the room to provide natural light. They should be covered with a protective screen. Window sills should be eight feet above the floor.

Electrical Outlets. Double-service outlets should be installed on each wall.

Equipment Storage Area. At least 200 to 300 square feet should be provided for storage. Cabinets and shelves should be installed. The equipment room should have a double door so wide equipment may be moved in and out easily. A telephone for emergency use should be placed in the equipment room.

Mirrors. Three full-length mirrors should be placed at one end of a wall, side by side, for visual analysis of movement.

Bulletin Board. Cork board should be hung on the wall near the entrance for posting materials and schedules.

Chalkboard. A chalkboard can be wall-mounted to facilitate teaching if this will not interfere with wall-rebounding activities. Otherwise, portable chalkboards can be used.

Drinking Fountain. One should be placed on a wall in the corridor just outside the door to the playroom.

Speakers. Two matched speakers should be placed high on the wall or in the ceiling. Jack plugs should be installed on each wall to use for speaker input.

Paint. Walls should be painted off-white or a very pale color. However, murals, accent colors and designs can be used for aesthetics.

Other Items. If the building is equipped with closed circuit TV, two outlets should be provided for receiver. There should be a separate entrance for recreational use. The teaching station should be isolated from other parts of the building for evening functions.

Adapted Teaching Station

Local philosophy and state/federal laws vary as to the inclusion of physically and mentally impaired students in regular physical education classes. A separate adaptive teaching station would be an ideal setup but any special program for such students often has to be accommodated in the regular facilities (see Chapter 8).

*Secondary School Indoor Activity Areas**

Teaching Stations

The type and number of indoor teaching stations for a secondary school depends on the number of students and the specific program of physical education and related activities. In all situations, a gymnasium is required. By determining the number of teaching stations essential for the formal program of instruction, planners will have a basis for calculating other needs. Computation of the minimum numerical requirement is achieved by the following formula:

$$\text{Minimum Number of Teaching Stations} = \frac{\text{700 Students}}{\text{30 per Class}} \times \text{5 Periods per Week} \div \text{30 Periods per Week}$$

$$= \frac{3500}{900} = 3.9$$

The fraction is rounded to the next highest number, making four teaching stations the minimum requirement. This number would also afford some flexibility of class scheduling.

In computing teaching station requirements for the secondary school, the desired class size must not be set so low as to require an impossible number of teachers and facilities, nor should it be so high that effectiveness is impaired. An average class size of thirty is recommended with daily instruction the ideal. However, if the physical education classes meet only two periods per week, the total number of class periods per week in the formula must be adjusted accordingly.

Teaching Stations for Other Activities

The next step for planners is to determine the degree to which the number of teaching stations for the program of instruction will meet the needs for voluntary recreation, extramural and intramural activities, and interscholastic athletics for girls and boys, as well as the possible use of facilities by the community. The needs must be based upon the season of the year representing the greatest demand for facilities.

The following guide can be used to determine the number of teaching stations needed for activities other than the formal program of instruction in physical education:

Minimum number of teaching stations, or fractions thereof, needed for interscholastic-team practice at peak load

plus

Minimum number of teaching stations, or fractions thereof, needed for intramural and extramural activities

plus

Minimum number of teaching stations, or fractions thereof, needed for student recreation

plus

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*Physical education facilities for the middle school should follow the standards for secondary schools.

Minimum number of teaching stations, or fractions thereof, needed for community recreation
equals
The total number of teaching stations needed for any specific after-school period

To illustrate, assume a school has two interscholastic squads, an intramural program, a voluntary recreation group, and no community recreational use of facilities immediately after school during a specific season. The total needs are as follows:

Required Teaching Stations
equals
2 Interscholastic
plus
1 Intramural
plus
1 Voluntary Recreation
equals
4 Stations

The need for four teaching stations for the after-school program must then be compared to the number necessary for the formal program of instruction in physical education. If the after-school needs are in excess of those for the regular periods of instruction, the additional teaching stations should be provided. Careful administrative scheduling results in maximum utilization of facilities.

To clarify the situation, a chart may be prepared using the principle outlined above. Such a chart would list all of the after-school activities for boys and girls sports, for recreation, and for other activities, as in the following example:

Variety of Teaching Stations

A wide variety of teaching stations is possible, depending on the number of different activities that would appropriately be included in the physical education program. Among the possible types of indoor teaching stations that might be included are gymnasiums, rhythm rooms, rooms for gymnastics, adapted physical education rooms, wrestling rooms, classrooms, swimming pools, archery ranges, rifle ranges, and racquetball courts.

The problem for some schools is not lack of an adequate number of teaching stations, but rather lack of facilities to accommodate the desired variety of activities. For a secondary school with 360 students, a divisible gymnasium will create an adequate number of teaching stations for the program of instruction in physical education but may not meet the peak load requirement for after-school activities. The facility must be planned and designed to serve all program needs as adequately as possible.

Whenever a school's teaching requirements are such that a basic gymnasium is inadequate, planners should consider special purpose stations, such as an auxiliary physical education teaching station, a natatorium, or a dance studio.

SECONDARY SCHOOL GYMNASIUM

The building or portion of the school that houses the gymnasium should be easily accessible from classrooms, parking areas, and the outdoor activity area. This also makes possible use of the facility after school hours or during weekends or holidays without having to open other sections of the school.

Size and Layout

For general purposes, allow a minimum of 125 square feet of usable activity space for each individual in a physical education class at peak load. The space requirements and dimensions of a gymnasium floor are significantly influenced by the official rules governing court games, particularly interscholastic basketball, and the extent of spectator seating. The minimum dimensions required of a gymnasium for basketball, however, should be expanded, if necessary, to accommodate other activities. In some instances, an entire gymnasium is not required for an activity. Folding, soundproof partitions can be used to divide the area and provide two teaching stations.

Walls and Ceilings

The walls of the gymnasium should be of a material that is resistant to hard use, at least to door height. The finish should be non-marking and have a smooth, non-abrasive surface. All corners below door height should be rounded and there should be no projections into playing areas. Lower portions (10') of the walls should be finished with materials that can be easily cleaned without destroying the finish. An epoxy paint on cement block makes a durable finish.

The ceiling should be 24 feet to the low side of beams or supports, with fixtures attached to the beams to support hanging equipment. High ceilings are expensive, and a natural method for cutting construction costs is to minimize ceiling height. If this is in the area for basketball, volleyball, gymnastics, badminton or tennis, it can be a critical error. However, in an auxiliary gym used for wrestling, dance, combatives, weight lifting or table games, a 12-15 foot ceiling is acceptable.

All ceilings should be light in color and, if support beams are below the ceiling, they normally are painted the same color as the ceiling or background. Contrasting colors have been used effectively, but such color contrast may make it difficult to follow the flight of an object.

Acoustical treatment of ceilings and walls is important where teaching is to take place. To get the best results, at least two adjacent surfaces should be treated. Many types of acoustical treatment are available. However, avoid those which will chip or break when hit with a ball.

Floors

The biggest decision that needs to be made with respect to floors is whether to go with hard wood or synthetic surfaces. Each type of floor has certain advantages and disadvantages. Careful consideration should also be given to the location of lines for various activities and floorplates for standards or gymnastic equipment.

Lighting

There are many types of lighting systems which will produce the 50 footcandles needed for a good teaching and spectator area. For television, the footcandles should be closer to 200 fc. and that requires more sophisticated lighting systems. When selecting a lighting system, compare initial costs, annual replacement costs and operational or electrical expenses. Some are less expensive to install but very expensive to maintain or operate.

Windows

Windows should generally be avoided. When located to

take advantage of the sun for solar heat, the glare may cause serious problems. When windows are on the north side, there is less glare, but the loss of heat may be significant. Vandalism is another disadvantage.

Folding Partitions

Folding partitions make possible two or more teaching stations in the gymnasium. They should be power-operated, insulated against sound transmission and reverberation, and installed to permit compensation for building settlement. The control should be key-operated. The design and operation must ensure student safety. Partitions should extend from floor to ceiling and may be recessed when folded. Floor tracks should not be used. A pass door should be provided at the end of a partition. When partitions are installed in gymnasiums with open truss construction, the space between the top of the folding doors and the ceiling should be insulated against sound transmission.

Fixed Equipment

If suspended equipment is planned, provision for its attachment should be made before the ceiling is installed.

Basketball backstops will need special care in their installation to ensure rigidity and safety. All basketball backstops should be attached to ceilings or walls, and swing-up or fold-up models should be used where the backstops might interfere with other activities. In addition to the main court basketball backstops, provision should be made for other backstops on clear sidewalls.

In the interest of safety, such suspension apparatus as bars, rings, and climbing poles and ropes should be so placed as to allow sufficient clearance from basketball backstops and walls, If wall apparatus is desired in the gymnasium, a strip of metal or hardwood firmly attached to the wall at the proper height is recommended. Wherever necessary, floor plates should be installed for fastening movable equipment such as horizontal bars and volleyball standards. If mats are to be hung in the gymnasium, appropriate hangers hung above head level to avoid any head injury must be provided. For safety reasons, padding should be installed on all walls in back of baskets. Rubber-tired mat trucks, which may be wheeled into a storage room, are recommended.

Spectator Seating

The extent of the demand for spectator seating depends upon each school and the community it serves. Modern design uses power-driven folding or rollaway bleachers which require little permanent space. If possible, the outer surface of folding bleachers should create a flat, wall-like surface so it may be used for ball rebounding.

The width of each seating space should not be less than 18 inches. Rollaway bleachers most commonly allow 22-inch depths for seats. The number of rows available in rollaway bleachers varies, with 23 rows the maximum for standard equipment. In some instances, bleachers with 30 rows can be obtained by special order. Planners should investigate local and state codes.

Balconies can be used to increase the total seating capacity beyond the maximum permitted at floor level. The space at both levels should be considered as activity area when the bleachers are closed. It may be desirable, in some instances, to provide less than maximum seating at floor level so a balcony will be wide enough to serve as a teaching station for specific activities. Balcony bleachers can be installed to telescope from the back to the front so that in the closed position they stand erect, creating a divider wall at the edge of the balcony. This arrangement affords partial isolation of the teaching station and enhances the safety of participants.

Traffic Controls

Good traffic control should permit the efficient movement of students to and from the gymnasium, locker rooms, and other related service areas. All traffic arrangements for spectators should provide direct movement to and from bleachers with a minimum of foot traffic on gymnasium floors. Spectators should have access to drinking fountains, refreshment counters, and toilets without crossing the gymnasium floor. Steep, high stairways should be avoided. Ramps with nonslip surfaces might be substituted in appropriate places. Local and state building codes and standards of the National Fire Protection Association should be consulted.

Foyers

Where finances and space will allow, foyers should be placed so they will serve as entries to gymnasiums and will guide spectators as directly as possible to seating areas. Toilet facilities for men and women, ticket-sales windows, ticket-collection arrangements, checkrooms, public telephones, a refreshment-dispensing room with counter, and lockable display case should be provided, opening directly to the foyer.

Lecture Room

The lecture room provides opportunities for formal instruction, conferences, chalkboard drills, staff meetings, movies, and so on. It may serve as a lounge for lettermen, a social center for teams after a game, and other similar uses.

Maintenance-Equipment Storage

Two types of storage rooms are necessary to every physical education facility. The first is for storage of large pieces of equipment needed in the gym, items such as volleyball standards and officials stands, gymnastic equipment, chairs, mats and score tables which, if left around the gym floor, are a safety hazard. This room should have easy access to the gym floor through double doors (with no center post and no threshold). The room should be planned to provide for current equipment and future expansion and should be keyed with safety lights in case of power failure.

The second type of room needed is for storage and repair of small equipment and supplies. Special bins, racks, hooks and nets, with a work bench for marking and minor repairs, adds greatly to the efficiency of the room. Ideally this room should be located near faculty offices.

Spectator Rest Rooms

All athletic events that attract large crowds require rest room facilities. Rest rooms should be designed for proper light, ventilation, and sanitary care. State health codes will influence the number and location of rest rooms.

Concessions

Concessions have come to be considered a necessary service for public gatherings. Appropriate space and distribution as well as adequate fixtures for concession stands within the field should be planned. Since plumbing and

electrical services are already available in the field house, the concession stand might be located as a part of or adjacent to the field house.

Other Factors

Provisions should be made for the installation of electric scoreboards, a central sound and public address system, picture projectors, a radio, television, high-fidelity equipment, and cleaning machines. Special consideration should be given to locating floor outlets for scoreboards and public address systems adjacent to the scoring table. Wall outlets should be installed near cupped eyes to permit special lighting as needed. Controls for gymnasium lighting should be conveniently located, recessed, and keyed.

Drinking fountains and cuspidors should be accessible without causing a traffic or safety problem. It may be desirable to provide a drained catch-basin, grilled flush with the floor, to care for splash and overflow.

Cupped eyes can be installed in all walls at approximately a 15-foot height and 10-foot intervals for decorating convenience. They may also be used for attaching nets and other equipment to walls at appropriate heights. Bulletin boards and chalkboards should be provided where needed. If wall space is available, such boards may be provided for each teaching station. Three full-length mirrors should be placed at one end of a wall, side by side, for visual analysis of movement.

The Auxiliary Gymnasium

Depending on the demands placed on a facility for classes, after-school athletics, intramurals and student and faculty recreation, more than one gymnasium may be necessary. Careful program scheduling will determine what is best in each situation. However, most schools need at least one auxiliary gym. Room dimensions should be based on the anticipated uses with special attention to the need to accommodate standard-size wrestling mats.

The other type of auxiliary gymnasium closely resembles the main gym except there is little or no need for spectator seating and the floor dimensions may be smaller. A 75 by 90 foot gym will house two volleyball courts, three badminton courts, three one wall handball courts, and space for some gymnastic equipment.

The auxiliary gyms can serve a variety of other activities in the instructional, intramural, recreational, or interscholastic program, which cannot all be accommodated after school in the main gymnasium. Some auxiliary gyms are large enough to be divided into two teaching stations. The characteristics of these facilities are similar to those in the gymnasium. A less expensive type may have a ceiling as low as 12 feet. Such activities as wrestling, tumbling, calesthenics, self-defense, and fencing may be conducted in such a room.

Adapted Area

Federal legislation requires that special considerations be made for the handicapped person. Schools must provide programs which meet their special needs. The adaptive area therefore becomes essential (see Chapter 8).

Gymnastics Area

By planning in detail the equipment layout for gymnastics, attachment hardware for floors, walls, and ceilings can be included in the original design and construction. The manufacturers of gymnastic equipment will supply details for the attachment of their equipment as well as suggestions for floor plans or layout of the apparatus with proper safety areas.

Storage of gymnastics equipment requires special attention. A room adjacent to the gym with extra high double doors and no threshold is desirable. Equipment left out or stored around the edge of the gym is a safety hazard and will shorten the life of the equipment. Mat storage requires either a mat truck or hangers. The use of light folding mats will, however, alleviate some of the storage problems.

Climbing ropes are attached to a height of 24 feet and drop to about three feet above the floor. Apparatus may be attached to the exposed beams. If the ceiling is placed below the structural members, the locations of suspended equipment should be planned and eyebolts provided during construction. Ropes should be placed five feet apart, allowing one for each five students in class. The rings should be at least five feet from the walls. End walls at least 35 feet from the point of atachment will afford safety for the participants. Traveling rings are supported from a height of 18 to 26 feet and are located seven feet apart along a continuous line. Lines should be provided for drawing ropes and rings not in use to the overhead so as not to interfere with other activities.

High bars require both floor and wall or ceiling attachments. Adjustable bars for class instruction can be arranged in a linear series. Bars vary from six to seven feet in length and require 12 feet of unobstructed space extending perpendicular to their long axis. Bars for interscholastic competition are commonly located as individual units.

By planning in detail the equipment layout for gymnastics, attachment hardware for floors, walls, and ceilings can be included in the original design and construction. The manufacturers of gymnastic equipment will supply details for the attachment of their products. Preplanning results not only in proper installation but also in savings on the cost of doing the work at a later date.

Dance Area

Few secondary schools have specialized facilities for dance. There is some indication, however, that specialized concentrations (dance, sports, aquatics, gymnastics) in teacher preparation is beginning to alter this pattern, particularly in suburban areas and in certain consolidated school districts. As these programs begin to establish their value, obtaining facilities may be easier.

A minimum dance facility will provide 100 square feet per student, one dimension to exceed 60 feet; full length mirrors at a corner for analysis of skill from two directions; a speaker system designed to distribute sound evenly throughout the room; a control system for record players and microphones; and practice barres on one wall at heights of 34 inches and 42 inches. For modern dance, the floor should be of hard northern maple which has been sealed and then buffed with fine abrasive. Poor floors, in either class or stage areas, are better covered with a square of battleship linoleum than with a ground cloth.

Portable percussion racks made in an industrial arts department can solve the problems of easy storage and efficient class and program use. Portable mirrors, six feet tall and eight feet wide, can be mounted 18 inches from the floor on rollers and moved into the dance area, if wall mounted mirrors are not feasible. Portable ballet barres of lightweight aluminum are desirable when unobstructed wall space is at a premium.

Adaptive rooms, gymnastic rooms, weight training rooms,

or recreational game rooms may have spaces available for dance. Careful preplanning of new facilities suggests the possibility of combining two or more of these.

Other Indoor Facilities

Some activities require specialized equipment and areas that may be provided in a main or auxiliary gymnasium. Even with careful planning, it is difficult to make adequate provisions without some compromise. In some activities, such as aquatics, the very nature of the activity necessitates a separate facility. The natatorium is considered separately in Chapter 4.

College/University Indoor Activity Areas

Colleges and universities in the United States are facing complex problems related to enrollment and economics. The magnitude of these problems has made the development of a master plan essential to college and university development. Space requirements of various programs of the institutions of higher learning have caused those responsible for master-plan development to request standards for facilities in terms of square feet per student. Standards in these terms are meaningful to campus planners, since relating standards to predicted enrollment results in assured space for all disciplines involved.

The following standards are recommended for consideration by those involved in planning college and university facilities for physical education, intramural sports, intercollegiate athletics, and recreation. It has been estimated by intramural leaders that the extent of participation in physical recreation by graduate students is 25 percent of that of undergraduates. Consequently, it is suggested that planners add 25 percent of the graduate enrollment when computing space needs for recreational areas.

Teaching Stations

Space requirements: 8.5 to 9.5 square feet per student (total undergraduate enrollment).

Includes: gym floors, mat areas, swimming pools, courts, and the like (adjacent to lockers and showers and within 10-minute walking distance of academic classrooms).

Breakdown of Indoor Space:

- Large gymnasium areas with relatively high ceilings (minimum 22 feet) for basketball, badminton, gymnastics, apparatus, volleyball and the like (approximately 55 percent of indoor space).
- Activity areas with relatively low ceilings (minimum 12 feet) for combatives, therapeutic exercises, dancing, weight-lifting and the like (approximately 30 percent of indoor space).
- Swimming and diving pools (approximately 15 percent of indoor space).
- Racquetball/handball or squash courts (not included in percent breakdown, however it has been recommended that one such court is needed for 800 undergraduate students).

Ancillary Areas

Investigation indicates that a reasonable standard for determining the space needed for lockers, showers, toweling rooms, equipment storage, supply rooms, and offices associated with indoor space is a square footage equaling approximately 40 percent of the play or activity area in a gymnasium facility. As an example of how this figure may be used, assume that a building is being planned to provide 100,000 square feet of activity space. In other words, the square footage of the swimming pool surface and deck and of all gymnasium floors, including high and low ceiling areas, equals 100,000 square feet. The space needed for ancillary areas would be in the neighborhood of 40,000 square feet.

All other space in a building, including hallways, stairways, wall thicknesses, lobbies, public toilets, bleachers for public use, custodial space, and space needed for service conduits of all types, is spoken of by many architects as "tare." By adding tare, ancillary, and net space, a rough estimate of the gross footage of a building plan can be computed. This figure is helpful in preliminary discussion of costs involved.

Enrollment Relationships

When standards in terms of square feet per student are used as guides in college or university planning, it is natural to ask where the computation begins. At what point, from ten students up, do the standards become meaningful? Obviously, for a college of 200 students, nine square feet per student of indoor area for sports and athletics would be woefully inadequate. It would not even provide one basketball court.

A university or college meeting the space standards for 1,500 students represents the minimum physical recreation space needs of any collegiate institution. As a college or university increases in size, these standards are applicable regardless of enrollment.

Peak Load After School Hours

Study at various universities has shown that the greatest load on facilities each day occurs between 4 and 10 p.m. As long as the requirement in basic physical education is not greater than two years, the greatest demand for space appears to come after the usual school hours.

A few universities have dropped required physical education in the belief that this will reduce the pressure on facilities for sports and athletics. In fact, the elimination of a physical education requirement may increase the demands for this type of space, since all students will then tend to use after-school hours to meet their physical activity needs.

Specific Activity Areas

Gymnasiums (Main Area)

The type and size of gymnasium facilities needed for a given college or university will depend upon many factors, including the anticipated enrollment. A gymnasium building planned to serve 2,000 students will, obviously, be considerably smaller than, and different in design and construction from, a facility planned for a university of 10,000 or more students. If a college or university has a definite enrollment ceiling, the building may be planned for this enrollment. If the enrollment ceiling is indefinite, however, the structure should be planned so additions to the buildings are feasible. Universities of 15,000 or more students may find it desirable to build more than one gymnasium structure, each servicing an area of the campus.

Another factor that will affect the type of building constructed is the philosophy of the administration concerning athletics and physical education. Many questions need to be

answered before planning begins:

- Will all students be required to take physical education for one, two, three, or four years?
- Will the required program provide the students with a great many opportunities to develop sport skills?
- Is teacher education in physical education to be part of the program?
- What responsibility does the college or university take for the physical education, recreation, and fitness of its faculty?
- Will research in physical education, health, and recreation be an important aspect of the program?
- What will be done to provide facilities for an expanded program of campus recreation (including intramurals)?

Principles of Planning and Construction

Indoor facilities for sports and athletics should be planned so that all activity areas will be available to both men and women. Good planning will permit easy access to all areas from both men's and women's locker rooms. This type of planning permits the flexibility necessary for efficient utilization and control.

Roll-away or folding bleachers should be used in order to use the available space efficiently. Most colleges and universities can neither afford to invest large sums of money nor give large areas of space to permanent seating that is used only a few times each year.

The traffic patterns for a building should be carefully studied. Lockers, showers, and toweling rooms should be centrally located in the building so they may serve all activity areas. Easy access should be provided from the locker room to the playing fields adjacent to the building.

Storage rooms for equipment and supplies should be carefully planned and functionally located. These rooms should be of three types:

- Central receiving storage rooms, to which all equipment and supplies are delivered and which should be accessible by truck.
- Utility storage rooms adjacent to gymnasiums so bulky equipment may be easily moved to the floor and back to storage.
- Overhead doors or double doors should be large enough to permit free movement of heavy equipment.
- Supply rooms with an attendant's window opening to the locker rooms.

Off-season storage rooms are critically needed. The type of equipment to be moved and stored will define the dimensions of the room and size of the doors needed. Reserve storage should also be provided.

Location

If physical education and athletic facilities are used by all the students, the gymnasium facility should be located conveniently near the academic buildings and student housing. Buildings used only for intramural and intercollegiate activities may be located farther from classrooms and housing. This is especially true if the activities promoted in these buildings are scheduled. If the building is to be used for unscheduled participation of students, however, the amount of use will vary inversely with the distance from housing and other campus buildings.

Guidelines for Determining Needs

The physical education building should include one main gymnasium to be used for general physical education class work, intramurals, and intercollegiate athletic activities. Ideally, the size of the floor for an enrollment of 4,000 students would be approximately 140 by 140 feet. (Use a rectangular dimension if the facility will be heavily used for spectator sports.) This size would provide for one official and three junior-size (35 by 84 feet) basketball courts, with adequate space between the courts and walls. If desirable, folding partitions can be used to provide three practice gymnasiums, each 48 by 140 feet. For the basketball courts, backboards that swing up to the ceiling are needed, since nonfolding backboards would interfere with court usage for activities such as volleyball and badminton. In order to increase the number of other instructional units, electrically controlled partitions should be installed.

If the gymnasium is to be used for intercollegiate athletics, seating must be provided for spectators (three square feet per person). Portable folding bleachers, which can be easily moved, are recommended for seating. In larger institutions, it may be necessary to install roll-away bleacher seats in the balcony, which, when combined with the bleachers on the main floor, will provide the required number of seats.

The varsity basketball court should be laid out lengthwise in the center of the gymnasium. Recommended court dimensions and markings are included in Figure 7 taken from the NCAA Official Rules Booklet. For the college game, the only acceptable backboard is a rectangle 6 feet (1.83 m) wide by 4 feet (1.23 m) high. The bottom edge of the board must be padded. The upper edge of the basket rings must be 10 feet (3.05 m) above the floor.

Where intercollegiate basketball is played, there should be adequate provision for sportswriters. A press box is recommended if conditions permit. The placing of tables adjacent to playing courts is not a good practice. Provision should be made for telephone and telegraph connections, for reception and transmission lines for television, for timing and scoring devices, and for the operation of a public address system, including stereophonic music.

Volleyball has been gaining in popularity as an intercollegiate and interscholastic sport. As power volleyball has become the dominant style of play, proficiency has improved markedly. This has created a real concern for perimeter space needs and adequate ceiling height to allow optimum performance levels. Height recommendations for top flight volleyball is thirty feet. Unless the games are played in an arena which has unlimited ceiling space due to seating needs, it is difficult for an educational institution to justify the cost of a ceiling height in excess of 24 feet from the base of the ceiling support beams. This height will conform to the needs for basketball competition. (If construction design would allow support beams to be placed away from the area on each side of the floor where the ball is "set", in preparation for spiking, the height problem would be minimized.)

Of greater concern is the need for adequate safety space at the sides of the court to give players a chance to save errant hits without fear of colliding with bleachers and walls. A minimum of 12-15 feet for competition-style play is recommended.

Another concern is free space beyond the end lines. Servers in high level competition frequently stand about 12-15 feet behind the base line. Reasonable justification for this extra space must be made by facility planners responsible for

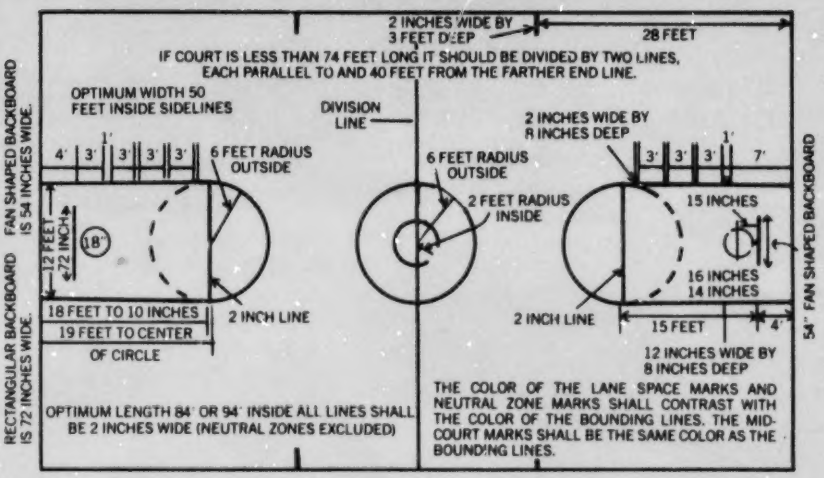

2 INCHES WIDE BY 3 FEET DEEP
28 FEET
IF COURT IS LESS THAN 74 FEET LONG IT SHOULD BE DIVIDED BY TWO LINES, EACH PARALLEL TO AND 40 FEET FROM THE FARTHER END LINE.
OPTIMUM WIDTH 50 FEET INSIDE SIDELINES
DIVISION LINE
2 INCHES WIDE BY 8 INCHES DEEP
FAN SHAPED BACKBOARD IS 54 INCHES WIDE
RECTANGULAR BACKBOARD IS 72 INCHES WIDE
4' 3' 1' 3' 3' 3'
6 FEET RADIUS OUTSIDE
12 FEET 72 INCH
18"
18 FEET TO 10 INCHES
19 FEET TO CENTER OF CIRCLE
2 INCH LINE
6 FEET RADIUS OUTSIDE
2 FEET RADIUS INSIDE
3' 3' 3' 1' 7'
15 INCHES
16 INCHES
14 INCHES
2 INCH LINE
15 FEET
4'
12 INCHES WIDE BY 8 INCHES DEEP
54" FAN SHAPED BACKBOARD
OPTIMUM LENGTH 84' OR 94' INSIDE ALL LINES SHALL BE 2 INCHES WIDE (NEUTRAL ZONES EXCLUDED)
THE COLOR OF THE LANE SPACE MARKS AND NEUTRAL ZONE MARKS SHALL CONTRAST WITH THE COLOR OF THE BOUNDING LINES. THE MID-COURT MARKS SHALL BE THE SAME COLOR AS THE BOUNDING LINES.

Figure 6
Multi-purpose gymnasium with suspended track at the Ohio State University. Figure 7 (right) – NCAA - approved basketball court diagram (from 1979 NCAA Basketball Rules)

overall educational programs. The United States Volleyball Association has adopted the International Volleyball metric system for court dimensions. Planners should be alert to changes in court dimension. (See Figure 7A.)

When an area is designed for an activity that will require the use of a piano, phonograph, or tape recorder, a space should be provided for storing this equipment. Electrical outlets to provide current at all times will be needed for such equipment as amplifiers.

Other audiovisual aids can include still and movie projectors, daylight-projection screens, television sets, a scoreboard, a clock, chalkboards, and an intercommunication system.

Concrete is commonly used as a base for constructing the floor of the main gymnasium. Then sleepers are laid on edge. Maple tongue-and-groove is the most popular type of wood finish, but synthetic flooring is gaining popularity. Synthetic surfaces are either laid in strips over concrete or poured in a liquid state over a concrete base.

It is suggested that a glazed-tile wainscot or a coat of epoxy paint be carried up to a height of seven or eight feet. From that point to the ceiling, the concrete or cinder block should be painted in a light color.

If an elevated jogging track is constructed, it should be at least seven feet wide and 12 feet above the gymnasium floor, providing it does not interfere with activities on the main floor. The surface should provide some cushion and good traction, with consideration given to banking the curves depending on circular length.

Gymnastic Area

In addition to the main gymnasium where gymnastic meets, exhibitions, and other competitions are held before a viewing public, a separate gymnasium should be provided for the permanent installation and storage of apparatus and equipment and for instruction in gymnastics. The dimensions of this gymnasium should be determined by space requirements needed to accommodate the apparatus and equipment to be installed, by space needs for performance in gymnastics, and by total school enrollment and interest in gymnastics. Ideally, the size of this gymnasium should be 120 by 90 feet, with a minimum ceiling height of 23 feet. This height permits a clearance of 22 feet for the rope climb and is ideal for hanging the various mechanical systems used in gymnastics. Some have found it desirable to install tracks on the ceiling supports to make it possible to use trolleys for moving equipment and for attaching safety belts used in the instruction of tumbling and vaulting.

Floor plates for attaching equipment should be recessed and flush with the floor. It may be necessary to reinforce the floor to install floor plates where tension is unusually severe. Wall boards should be securely installed to the wall when equipment is attached to it. Apparatus suspended from the ceiling should be securely attached to metal supports.

The ceiling should be acoustically treated. Lights should be shielded. Doors should be constructed without a threshold and wide enough to accommodate the movement of equipment to other areas. The facility should be air-conditioned in accordance with standard specifications. Wall construction should be of the same materials as recommended for other gymnasiums.

A common failure in planning is to overlook the need for adequate and conveniently place storage space for gymnastic equipment. If multiple use of this equipment is expected, transportation carts and dollies should be provided. Specifications on size and installation of the various pieces of apparatus and equipment may be obtained from manufacturers. Ideally, the gymnasium for gymnastics should be equipped with the following types of items: side horse, horizontal bar, long horse, parallel bars, bucks, trampoline, mats, still rings, uneven parallel bars, balance beam, and other special apparatus.

A gymnastic landing pit, 10 feet wide, 20 feet long, and 30 inches deep, filled with sponge rubber — for use with parallel bars, horizontal bar, still rings, and uneven parallel bars is a desirable feature.

Weight Training/Body Conditioning Room

This room should contain a minimum of 2,500 square feet of floor space. Such space will provide a weight training area and space for the practice of official events in competitive weight lifting. The floor should be covered with a durable,

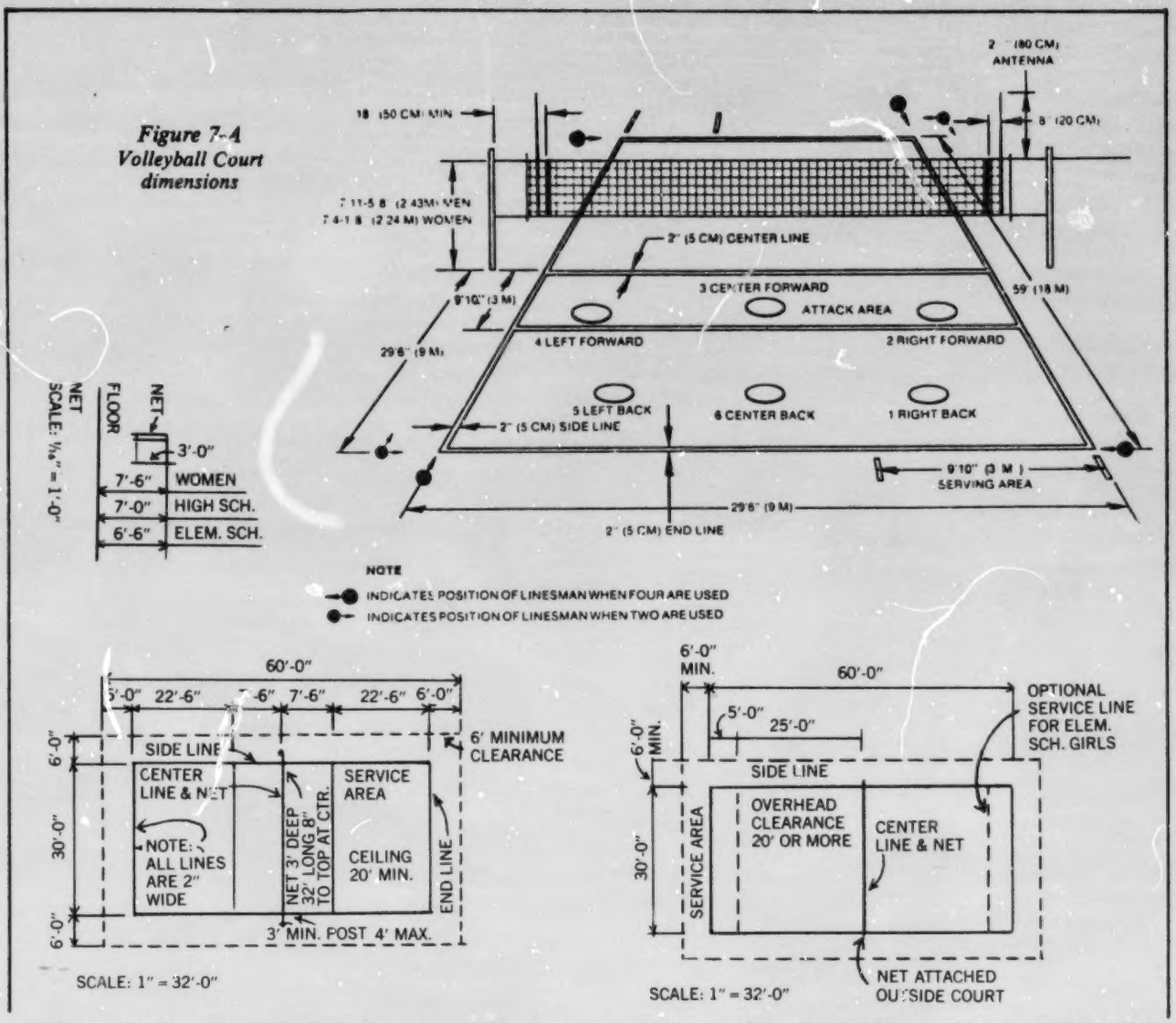


Figure 7-A
Volleyball Court dimensions

resilient material, making it unnecessary to use weight platforms, which are essential to protect a maple or other wood flooring.

The weight lifting area should be roped off and should be approximately 15 by 15 feet for the practice of official lifts. The rest of the room may be used for exercise with barbells, dumbbells, isometric cables, and the like. Several full length mirrors should be installed on the walls. Barbell and weight racks should be attached to the walls so the room may be kept tidy.

Wrestling and Martial Arts Area

This area is designed for wrestling and martial arts activities. The room should be rectangular in shape, at least 50 x 100 feet, and should be of sufficient size to accommodate two square mats, each measuring a minimum of 42 x 42 feet (See Figure 9). The mats should have 10-foot practice rings consisting of 3 rows of 6 circles to each row for a total of 18 practice rings. A satisfactory standard is 10 by 10 feet or 100 square feet per student during peak usage based on 40-45 students per class. The floor area not covered by the regulation mats should be covered with carpet for classroom instructional type atmosphere. The ceiling should be of acoustic material and should be a minimum of 12 feet high.

The floor of the wrestling room should be constructed of or covered with resilient material to prolong the life of the mats. These materials may be rubberlock products, other new developed resilient materials, or wood. Concrete is not recommended. The wall mats should be covered with resilient materials up to five feet above the floor on all sides. Adequate lighting, heating, and forced ventilation are essential in this room. A wall type water fountain with a cuspidor should be present. A blackboard and bulletin board should be available as well as a scale. An electric scoreboard wall clock should be attached to the wall. A sound system should be present, with a wall pulley machine and a takedown machine included as basic equipment.

Multi-Purpose Activity Area

The size of this room should be approximately 70 by 90 feet. A floor for street shoe usage may be needed in any size college or university with a variety of program offerings. The floor most commonly used is hard maple, tongue and groove, conventional gymnasium flooring. Square dance, folk dance, social dance, physical education for elementary teachers, marching and band practice, and similar activities can be

conducted on such a floor. It can meet the demands of such special college and community events as musical and dramatic productions, fairs, and carnivals. The "make-up" room or "warming room" for department and college outdoor programs can be housed in this area and can be served through a door leading to a corridor and immediately to the out-of-doors.

This activity room, when not scheduled in some manner as indicated above, can serve the purposes of any regular gymnasium if so planned in its equipment and floor markings. The floor may need some extra maintenance for the hard use it will receive, but the desirability of the activities that may be scheduled on it will justify the resultant wear.

Multi-Purpose Game Area

The intended use of a multiple-purpose room will determine its dimensions. It should be large enough to accommodate at least six table tennis tables. A ceiling height of 12 feet is adequate. The room should be equipped with a public address system and record player for instructional and recreational activities, including social and square dancing. This room should be accessible from the lobby or from a building corridor. It should have small kitchen facilities and a floor that can take hard usage. The handicapped should be considered in the planning.

Racquetball/Handball Courts

Suggestions for court construction are the same for both racquetball and handball. Figure 11 shows the measurements of regulation indoor racquetball courts. The recommended four-wall court is 40 feet long and 20 feet wide, with a front wall and ceiling height of 20 feet, and a back wall at least 12 feet high.

When more than a single battery of racquetball/handball courts is to be constructed, the batteries should be arranged so the back walls of each battery are separated by a corridor approximately 10 feet wide and 8 feet high. A corridor located immediately above and at least 12 feet high may serve an instructor or be used as a spectator gallery. Corridors and galleries should be illuminated with indirect light.

The back wall of a single court need not be higher than 12 feet. Shatterproof glass or plexiglass may be used to enclose the remainder of the back wall. Many courts are satisfactorily used with an open upper rear wall.

Racquetball/handball courts may be constructed of hard plaster, fiber board or laminated wood panels, concrete, shatterproof glass, or a nonsplintering durable wood. While plaster is sometimes recommended, maintenance costs may be high. Glass courts provide maximum spectator participation, but the initial cost may be prohibitive. Overall, a reputable panel system is probably the best alternative for selection of front wall, side walls, and ceilings. Floors should be hardwood, as in standard gymnasium construction.

Entrance doors should open toward the corridor and have flush pulls and hinges. A small shatterproof window installed flush with the interior surface of the door should be located at approximately the eye level of an average adult male.

Such fixtures as heat pipes, ventilating ducts, lights, and other mechanical equipment should not project into the playing area. Ventilating ducts and lighting fixtures are best installed flush with the ceiling surface.

A recommended method of turning the lights on and off in handball and squash courts is to install switches that are activated by the opening or closing of the door to the court. When the door is opened, the lights will turn off automatically, leaving only the night light to burn continuously. When the door is closed, lights in the court will turn on. Usually, a two to three minute delay occurs prior to the lights going off after the door has been opened. This prevents a disruption of lighting during the brief time it takes for players to exchange the court. This system eliminates the possibility of the lights being left on when the courts are not in use.

However, the lights, when turned off, will come on instantaneously when new players enter the court and close the door. With this system, warning lights can be located outside each court to indicate when a court is in use. A relatively new concept utilizes an annunciator (an electrically controlled signal board) to indicate to the building reservation/control center which courts are occupied at any one time. Lights on the signal board are activated by the "trip" switch on each door as it opens or closes.

Figure 8
Multi-station conditioning machines offer diverse exercise activities and permit several persons to work out at the same time.

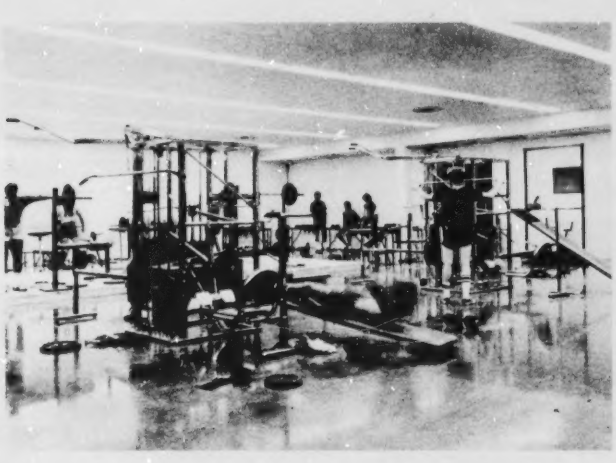
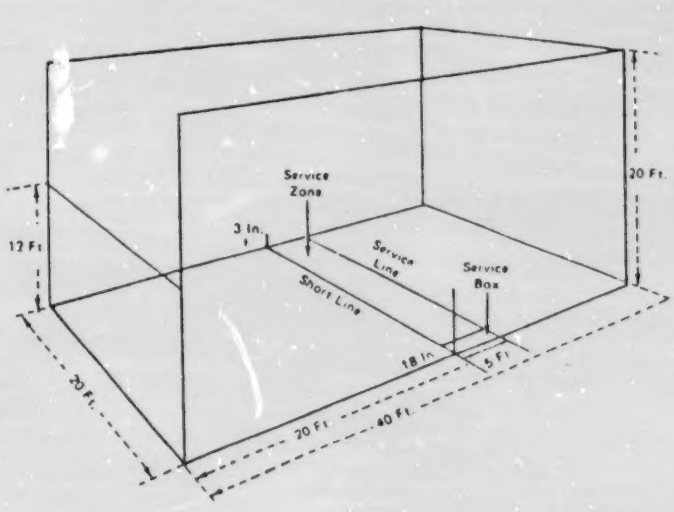
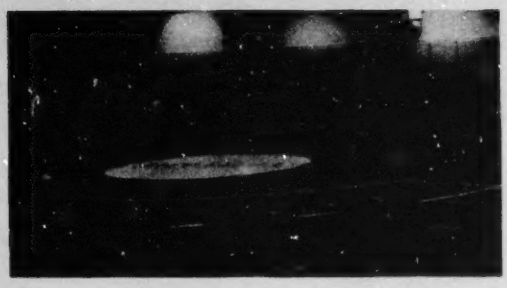


Figure 11
Dimensions of a Racquetball Court





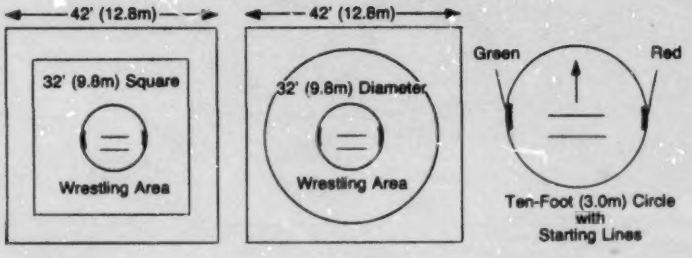


Figure 9

At Sinclair Community College in Dayton, the wrestling mat is located in a practice room equipped with padded walls for safety. Right: Official NCAA wrestling mat layout.

Air-conditioning, or at least forced ventilation, is desirable for this area. For additional suggestions regarding racquetball club/court construction, refer to Chapter 7.

Squash Courts

Squash is very popular in some localities and the number of courts should be determined by local interest. A singles court is 18.5 feet wide by 32 feet long and 15 feet high. A doubles court is 25 feet wide by 45 feet long and 20 feet high. (See Figure 10).

It is possible to install movable metal "tell-tales" across the front of handball/racquetball courts so they can be used for squash instruction purposes. The floors, walls, ceilings, lighting, heating, and ventilation of squash courts are similar to those of four-wall racquetball/handball courts.

Fencing Area

Fencing is often included in the instructional, recreational, and intercollegiate programs for both men and women. The field of play is a piste, or more commonly referred to as a "strip" within the United States.

A room 55' x 90' allows for four fencing strips 40 feet long and 6 feet wide, with 15 feet between strips. These strips may be used for informal competition and instruction. Intercollegiate competition, however, requires a 52 foot length of floor area, with a minimum of 18 feet betwen the strips. (See Figure 12).

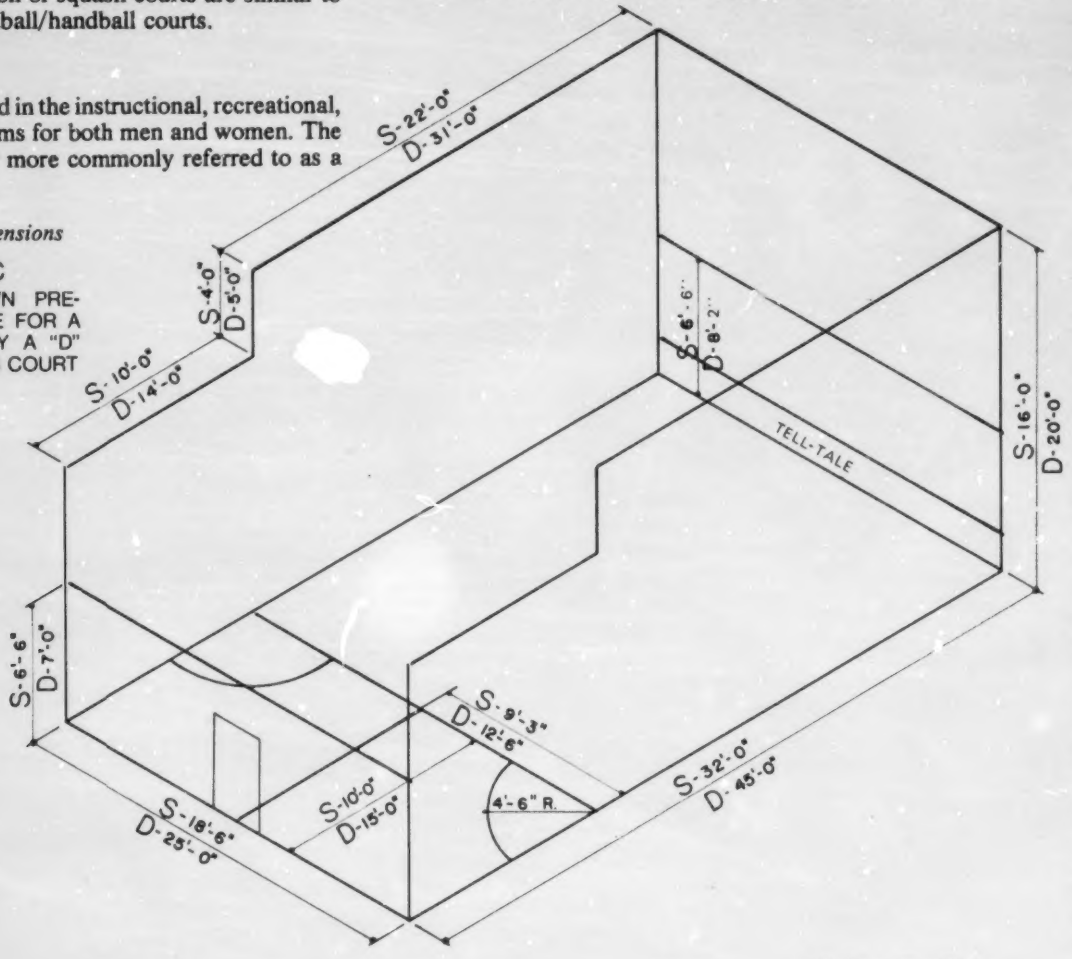
For instructional purposes, the strip may be painted on a nonslip hardwood floor, be inset in linoleum, or a rubber runner of correct measurements may be laid on the floor and removed when not in use. For the electric foil and epee, a metallic piste must cover the entire length of the strip, including the extensions.

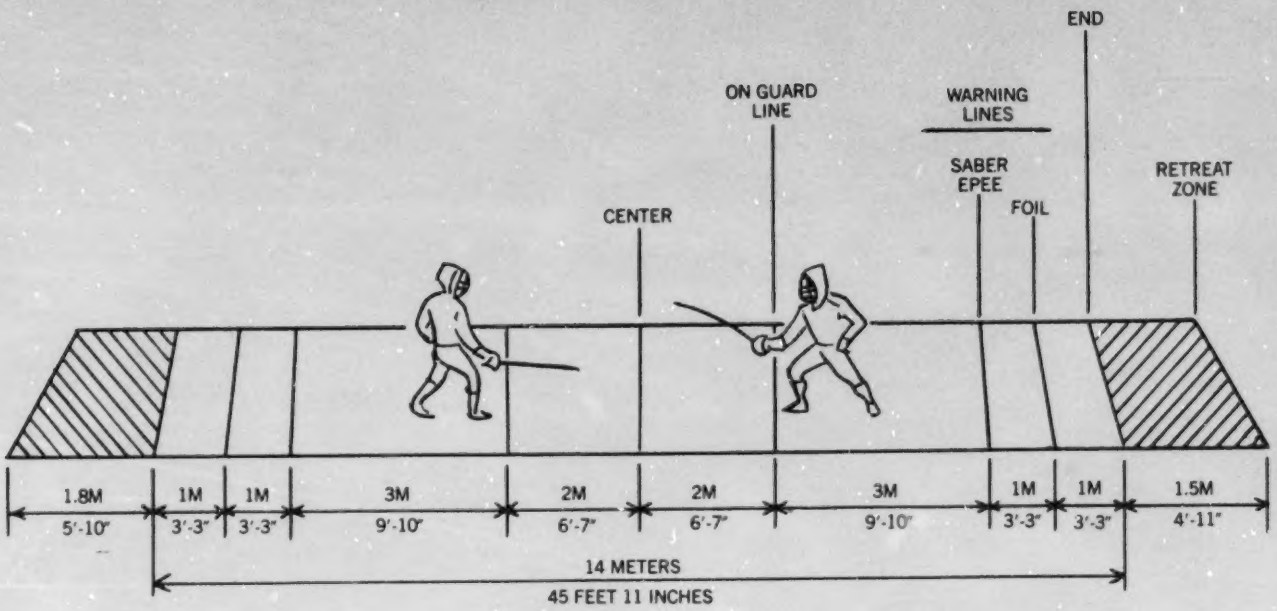
Electrical outlets and jacks should be placed at the rear of

Figure 10
Squash Court Dimensions

ISOMETRIC

DIMENSIONS SHOWN PRECEEDED BY "S" ARE FOR A SINGLES COURT; BY A "D" ARE FOR A DOUBLES COURT





NOTE: The width of the strip shall be a minimum of 1.8 meters (5'-10") and a maximum of 2 meters (6'-7"). The length of the retreat zone shall be a minimum of 1.5 meters (4'-11") and a maximum of 2 meters (6'-7"). For Foil and Epee, the metallic surface of the strip shall cover the entire retreat zone.

Figure 12

the tournament strips to provide power for the electrical equipment. If permanently affixed wall scoreboards are provided, portable score boxes are unnecessary. Brackets or eyebolts for mounting fencing targets should be either recessed flush with the wall or placed above the seven foot level.

The fencing area should be a well-lighted room with a minimum ceiling height of 12 feet. The installation of roll-away bleachers for spectators may necessitate raising the ceiling height, and it may also require an increased capacity ventilating system.

An equipment room should be located adjacent to the fencing room and should be large enough to store the weapons and protective equipment used by classes. Sixty square feet is the minimal space required for storage and to accommodate a small cabinet work counter for the repair of equipment. Portable strips will require additional space.

Indoor Tennis Facilities

Tennis can be played indoors on any firm surface of sufficient size for a tennis court, and where court markings and a net are provided. Sometimes tennis court markings are placed on the general use gymnasium floor and provisions are made for temporary placement of net posts, or the net is attached to rings inserted in the wall. Portable tennis courts might also be used in the gymnasium or field house.

A few colleges have constructed a special indoor facility specifically for tennis. If this is done, the facility should include a minimum of four courts, along with a tennis drill area. Such a facility would enable 16 students to play tennis, while other students use the tennis drill area. This approach would demand frequent rotation of students.

If the courts are in a separate building, it should be conveniently located to locker rooms. Consideration should also be given to a covered passageway between the gymnasium and the tennis building.

Ventilation, lighting, temperature control, and other pertinent considerations are discussed in Chapter 7.

Indoor Archery Range

Instructional and recreational groups need an indoor archery area suitable for practice during inclement weather.

An area 78 feet long is adequate for official ranges of 10, 15, and 20 yards for indoor archery. The 78 feet includes 3 feet for the target, 60 feet for the range, and a 15 foot width is required for 24 students. This area will accommodate six 48-inch targets set 10 feet apart on centers, or twelve 5-foot lanes for indoor targets. A minimum ceiling height of 10 feet should be provided between the shooting line and targets.

The floor in the archery area will receive hard usage from street shoes and flying arrows. A hardwood, tongue-and-groove floor, with the boards running the length of the shooting area, is preferred. A durable synthetic surface may be considered but a wooden floor suffers less damage by arrows and helps reduce arrow breakage. Hard rubber runners may be placed along the shooting lane if desired.

The location of structural features in the archery room should be given careful attention. Obstructions ahead of the shooting line, such as supporting pillars and overhead lights in a low ceiling, should be recessed or otherwise protected from flying arrows. The area behind the target should be covered with a backdrop to protect the wall and prevent arrow breakage. A large heavy run, or a commercially available nylon net which arrows cannot penetrate, may be used. All doors and windows in the area should be located behind the shooting line. The same is true for tackboards and chalkboards.

Targets may be affixed to the backstop or placed on easels in front of it. A variety of targets are available including

straw, double-curl excelsior, and styrofoam with composition centers. The target should be constructed and placed so as to allow an arrow to penetrate at least 20 inches without striking any obstruction that would damage the arrow.

In a multipurpose room, target holders should be mounted on wheels or set in floor plates. The plates should be flush with the floor when the target holder is removed. The backdrop behind the targets should be pulled to the side or rolled overhead when not in use.

Storage space for targets and other equipment should be adjacent to the range. The size and location of storage areas will be determined by the type of targets used. Racks for hanging bows, and shelves for storing arrows should be included in a storage area behind the shooting line. This location enables a student to replace or exchange equipment while other students continue to shoot.

The feasibility of installing automated lanes should be seriously considered. Several types of commercial lanes are available. Automated lanes have lane dividers at the shooting line and an automatic warning system to halt shooting in the event a person steps in front of the shooting line. Electric target returns bring the targets to the shooting line so arrows can be removed, and the targets can be adjusted for different shooting distances without altering the shooting line.

Additional information concerning outdoor archery facilities can be found in Chapters 3 and 7.

Indoor Rifle Range

A rifle range can be used for class instruction, competitive shooting, and recreation for both men and women. On campuses where a range within the athletic and physical education complex is deemed not feasible, the ROTC units might be contacted for possible collaboration in constructing a range.

A room 75' x 42' will accommodate eight firing points, or a class of 24 students. At least eight firing points are recommended on the basis of one point for every three members of a class. The National Rifle Association standard shooting distance for rifles is 50 feet, measured from the firing line to the target. The bulletstop should be 6 to 10 feet beyond the target. This space varies with the type of installation.

A minimum of 15 feet is required behind the firing line for mats, scoring tables, rifle racks, and walking space. The ceiling should be 8 feet high in front of the firing points. This ceiling height reduces the amount of wall space that must be covered behind the backdrop, and facilitates the installation of target carriers. Each firing point should be at least 5½ feet wide.

For specifications on construction of indoor rifle ranges, write to the National Rifle Association of America, 1600 Rhode Island Avenue, N.W., Washington, D.C. 20036. The outdoor rifle range is discussed in Chapter 2.

Indoor Golf Practice Area

Provisions can be made to accommodate golf instruction and practice indoors. Balls may be hit into a large durable nylon net or canvas placed several yards in front of the hitting positions. Driving cages may also be used. Hitting positions may be established by placement of practice mats available from golf supply houses.

In addition, commercial golf systems are now available that will be a positive compliment to any instructional/recreational program.

Dance Facilities and Equipment

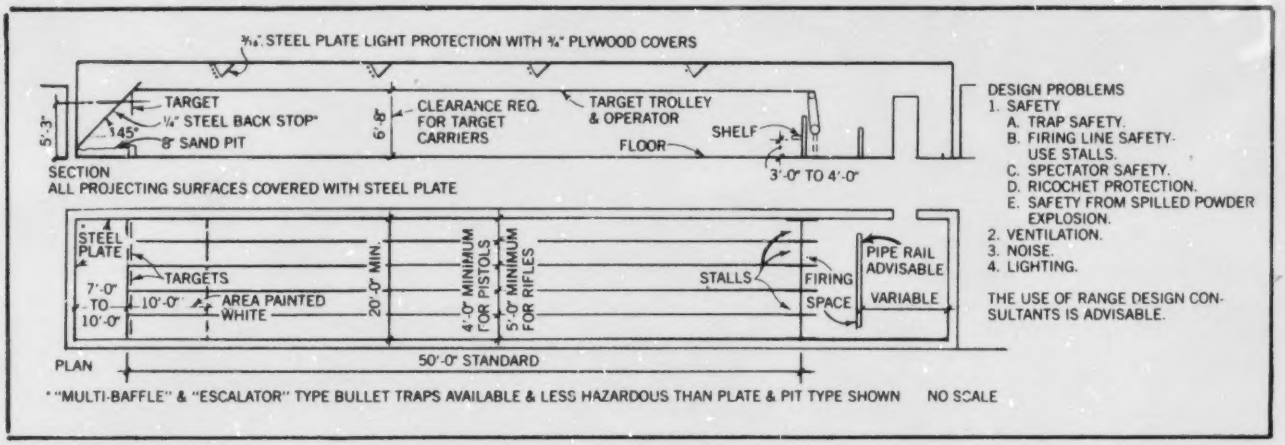
The essential dance facilities and equipment should be supplied in sufficient quantity and quality to provide for all dance activities in the required and elective curriculum and in the extracurricular programs. Particular attention should be given to adequate provisions for the program of professional preparation (both the teaching program and the performance program) and to dance performance and observation.

Provision should be made to include the following units if the dance facility is to be comprehensive:

- Locker-dressing rooms
- Shower area
- Toilets
- Rest rooms (remote from toilets and showers)
- Public lavatories
- Therapy room
- Storage spaces
- Construction rooms for costumes, props and sets, and music (composing and recording)
- Custodial space
- Office space
- Laundry and cleaning facilities
- Box office
- Parking area

Total facilities should be determined according to the amount of emphasis placed on various aspects of the dance curriculum. Considerations should include classes needed and areas for individual work and for extracurricular and

Figure 13: Indoor Rifle and Pistol Range



concert practice. Based on the design of the dance curriculum, facilities should be considered in terms of teaching space, practice space and choreography, rehearsal space, performance space, research space, auxiliary space and equipment, and classroom space. At least two distinct areas should be provided, one area for modern dance and ballet and one area for folk and social dance.

Modern Dance and Ballet Area

A minimum of 100 square feet per person is recommended. An area of 3,000 square feet will accommodate 30 students. If an area is to serve as an informal theater and instructional area, it should be between 4,800 and 5,000 square feet to accommodate both the class and the needs of the theater section.

A ceiling height of 24 feet is recommended for all dance areas. Full height is essential for large dance areas (over 2,400 square feet), and 16 feet is the minimum height for small dance areas.

Dance activities require air space between floor and foundation as well as "floating" floors for resiliency. Floors should be of hardwood, such as maple of random lengths, and tongue-and-grooved. They should be laid with the grain going in one direction. The floors should not be slippery and they should be constructed for easy cleaning.

The finish should provide a smooth surface upon which dancers can glide with bare feet or soft sandals. Tung oil is considered by most to be a satisfactory finish; an alternative might be several coats of wood sealer.

Walls should be smooth and easily maintained. Consideration should be given to having one unobstructed wall of neutral background for filming purposes. To support ballet barres, stress factors of the walls should be considered. Thin walls are inadequate.

Incandescent light is preferable to fluorescent light. Lights that also serve as houselights during performances should be controlled from wall switches as well as from the light control board.

Consideration should be given to natural lighting. Large windows contribute to an aesthetically and psychologically desirable atmosphere. To avoid direct sunlight, the best location for windows is the north wall. Windows should be curtained so the studio can be darkened for film showing and studio performances. When total construction necessitates no windows, the aesthetics may be improved by the use of color on the walls.

Storage space for sound equipment should be adjacent to the dance area and locked. Storage rooms should have double doors and a flush threshold for easy movement of such large equipment as a piano. Built-in storage space for records, sound equipment, tapes, and musical instruments should be provided. An area in the storage room where instructors can listen to records and tapes is highly desirable. This area should have adequate acoustics, ventilation, and electrical outlets.

Heavy-duty wiring is essential for all dance facilities. Wiring should be capable of carrying a portable light board as well as phonographs, additional speakers, tape recorders, and projectors. Wall outlets should be convenient to all areas. Television conduits should be installed when the building is constructed.

Temperature should be maintained at 65 degrees. The air should be well circulated, and consideration should be given to the use of natural air. Mechanisms for heating and circulating air should be as nearly silent as possible to avoid interfering with the quality of sound and its reception.

Planning for a dance facility should include consideration of accessories. Leaf-fold mirrors, which can be folded for protection or curtained during performances, may be installed along two adjoining walls so that movement can be analyzed from two directions. Wall mirrors should be installed flush with the wall and raised 12 to 18 inches from the floor.

Ballet barres should be smooth in texture and be made of wood, stainless steel, or aluminum. The minimum length to accommodate one dancer is five feet. Barres from 42 to 48 inches in height may be installed permanently; they should extend six to eight inches from the wall. If necessary, barres may be placed in front of mirrors. In such instances, it may be necessary to use pipes for the barres. The barre supports may be screwed into recessed floor sockets just in front of the mirror, thus facilitating the removal of the barre and supports when not needed.

Custom-made percussion cabinets mounted on rollers are a fine accessory. They may have a carpeted top surface, slide-out drawers lined with felt for small instruments, and larger partitions to accommodate cymbals and drums. Heavy sound equipment should be built in or placed on stands of table height equipped with rollers for ease of transportation. Because moving affects the tuning of a piano, this instrument should be placed on an inside wall where it will not be subjected to extreme heat or cold, and it should be protected by a suitable cover and lock. If it is to be moved frequently, the piano should be placed on a heavy duty dolly.

Chalkboards and bulletin boards are useful accessories. A glass-enclosed exhibit case for photographs, costumes, costume plates, manuscripts, and other items may be installed near the dance area.

Folk and Social Dance Area

An area of 5,400 square feet (54 by 100 feet is suggested) will accommodate a class of approximately 60 students. Dance areas are generally rectangular with a length-width ratio of approximately 3 to 2 (e.g. 90 by 60 feet). Ceiling height should be in proportion to the size of the room but never lower than 12 feet. An outside entrance into a main corridor of the building will provide for traffic flow of the relatively large groups using the area.

Floors as specified for ballet and modern dance are necessary. An epoxy finish will enable the use of street shoes without damage to the floor. Specifications for lighting, ventilation, acoustics, sound equipment, storage space, wiring, and temperature control should follow those for ballet and modern dance facilities.

Racks for coats and books should be installed either within the dance area or along the outside corridor wall.

Bulletin boards, chalkboards, and display cases are highly desirable.

For additional details concerning the construction of dance facilities (i.e. principles for planning, dance production areas, auxiliary areas, etc.), readers are encouraged to consult the booklet entitled *Dance Facilities* published by and available from American Alliance of Health, Physical Education and Recreation.

Badminton

Badminton is an individual and dual sport utilizing a shuttlecock and rackets. The activity may be included in programs for class instruction and intramural and recreational competitions. It is an excellent coeducational activity.

Figure 14
Commercially produced golf training devices aid players in refining their stroke technique

The court dimensions are 44 by 20 feet for doubles and 44 by 17 feet for singles.

Posts should be set five feet, one inch high in the center of the sidelines. The net should be five feet high at the center. In indoor or outdoor settings, a multipurpose space may be used for courts. In such instances, the courts should be in batteries of two or more, with 1.5-inch painted or taped lines superimposed on other appropriate areas. All measurements are to the outside of lines. It is recommended that additional space of four or five feet for the sidelines and eight feet for the ends be provided. (See Figure 17.)

Other Indoor Facilities

Information concerning the planning of indoor facilities related primarily to recreation (i.e. bowling alleys, ice arenas, etc.) is available in Chapter 7.

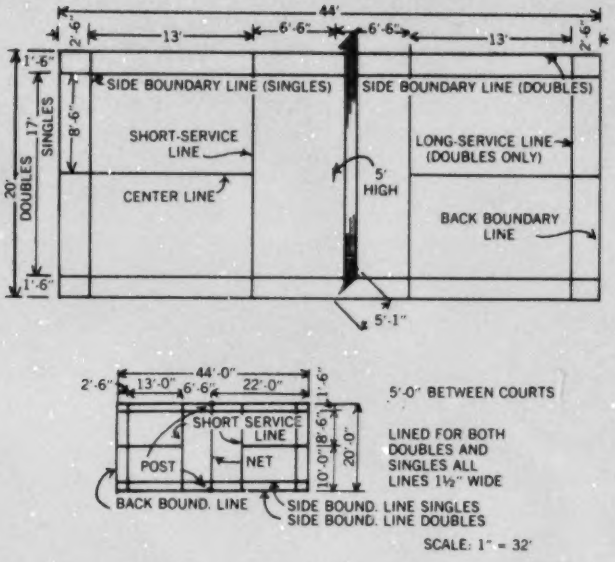


Figure 17
Badminton court dimensions

College/University Facilities for Research

Research facilities are becoming increasingly important in colleges and universities. In the quest for new ideas and in the re-examination of old ones, research plays an important role.

It is impossible to list all the tools that any individual investigator will want to use in research. A laboratory (in a sense) takes on the personality of the one who is in charge of the research being conducted there. The design facility is often dictated by the type of equipment to be used in it.

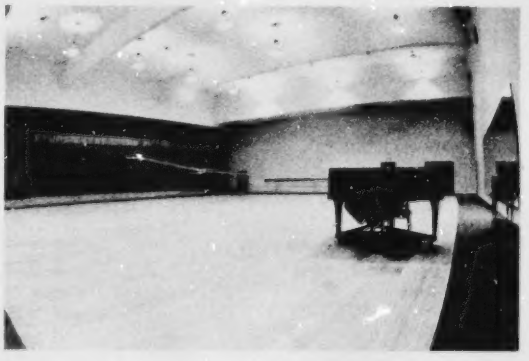
Despite the wide diversity in research tools, there are some facilities and equipment commonly used in laboratories for research in athletics, physical education, and recreation. Let us consider some general considerations and some specific types of research facilities now in use or projected for the future.

General Considerations

The nature of the educational institution and its objectives and function will determine in large measure the type,

Figure 16
This University of Denver dance studio displays wall-length mirrors and practice bar

Figure 15
University of Nebraska dance studio features flexible space arrangement and versatile lighting capacity.



number, size, and relative importance of research and teaching laboratories for athletics, physical education, and recreation. In junior colleges, or in four-year institutions in which only service courses are offered, sophisticated research laboratories will seldom, if ever, be required. However, laboratory experience may be desirable as a part of a course, and some testing equipment may be required for use in the gymnasium or on the playing field. Furthermore, there are liberal arts colleges and other research-oriented institutions whose undergraduate curriculums require that the student have research experience. In such institutions, it is not unreasonable to provide limited research facilities and supervision of selected research activities.

In colleges and universities offering professional preparation in physical education or recreation and especially in those with graduate curriculums in these areas, there is a greater need for the development of research and teaching laboratories. Such facilities are required, not only to provide experience and training for students, but also to attract and retain capable research scholars. Therefore, it is not possible to decide on a "per student" basis what kinds of laboratories or even, in many instances, how many square feet of laboratory space should be provided. The character of the institution and the interest and ability of its faculty must be taken into account.

Teaching and Research

Years ago, small research laboratories served as teaching laboratories in the conduct of various undergraduate and graduate courses for professional preparation. It is still necessary and desirable to use research laboratories for presenting occasional demonstration experiments in the teaching of classes. However, this cannot be a frequent practice in a productive research laboratory, especially when the classes contain more than just a few students.

Separate teaching laboratories should be provided to handle laboratory sections of various courses. The same teaching laboratory cannot be used for some of the laboratory sessions in a variety of courses, including tests and measurements, physiology of exercise, and biomechanics. At least one such teaching laboratory should be available, equipped with stationary lab tables containing gas, water, and electricity. Hoods for the Bunsen burner, cabinets for storing small pieces of equipment, and a connecting supply room are also essential. Closed-circuit television receivers are desirable. The laboratory can be designed to accommodate equipment used in conducting experiments with animals and human beings.

Frequently, the teaching laboratory can be equipped with durable, inexpensive, and easily serviced apparatus where students can carry on experiments individually or in small groups. While such equipment may not provide the degree of precision expected of sophisticated research apparatus it is generally accurate enough to present desirable principles. A space of approximately 1,000 square feet, with a 12-foot ceiling, is generally large enough to accommodate a class of 20 students.

A small gymnasium of approximately 2,000 square feet or more, with a ceiling height of 22 feet, may function as another teaching laboratory for conducting other experiments. This facility is useful for instructional purposes and for the student to gain experience in administering tests and taking measurements. Such a facility should be free of obstructions so that fitness or sport tests may be safely administered. Walls should be flat, without ornamentation or equipment, to permit wall-volley tests. Such items as chinning bars, mats, and volley-ball standards should be available.

As the fields of physical education and recreation advance in maturity as disciplines, it is probable that laboratory experience will replace some of the course lectures, particularly at the graduate level. This will increase the need for teaching labs as well as research labs. Graduate students should have considerable laboratory experience before they embark on collecting data for a doctoral dissertation.

Individual Laboratories

Several forces are acting to accentuate the role of the research investigator in colleges and universities. The availability of funds, greater specialization, increased research encouragement from the administration, and competition for university faculty have all had a positive influence on the place of research. The recent interest within the fields of physical education and recreation in developing a body of knowledge and the development and expansion of graduate programs in these fields have also created a greater demand for research facilities and trained investigators.

A sizeable proportion of some faculties are now doing research—sometimes several faculty members sharing a common interest or specialty. Provisions must be made for this increased interest and emphasis.

Joint appointments, in which a faculty member holds an appointment in more than one department, are increasing in number in the fields of physical education and recreation. Provisions should be made for some faculty members to do research in other departments, and conversely, members of other departments may be expected to use some of the physical education and recreation research facilities.

A related development is the organization in many large universities of centers or institutes for research that cut across departmental lines. There are a number of advantages to such organizational setups, including the cross-fertilization of disciplines and the sharing of elaborate facilities and expensive apparatus. In the planning of research facilities for physical education and recreation, the existing as well as the proposed institutes on the campus should be investigated.

Service Facilities to be Shared

Although there is a need for individual research laboratories, some facilities lend themselves to shared use. A workshop supervised by a capable machinist or other skilled worker is an essential ancillary facility in institutions where considerable research is being conducted. If the research productivity of the physical education and recreation unit is sufficiently great, there is justification for housing and supporting this type of ancillary facility in this unit. If, however, research and laboratory teaching is done on a smaller scale, the facility may be shared by other units in the college or university, or such services may be purchased as needed.

If a workshop is planned, 110v and 220v electric current with good ground connections should be made available. Oversized doors should be provided as well as a good ventilation system so that sawdust and other pollutants will not become a hazard or annoyance. Cupboards with locks should be in ample supply to store hand tools to prevent their being stolen or misplaced. Since considerable noise may be generated, the workshop should be isolated from other facilities where quiet work is being done. There should be a minimum of 80 footcandles of light on the task being performed. The room should be at least 500 to 600 square feet in size, with a ceiling height of 12 feet.

Another unit that lends itself to shared use is a data-processing center. This may be a small room housing a few desk calculators available for use by various faculty members, graduate or undergraduate students, and nonacademic personnel.

On the other hand, the facility may be expanded to include card punching and sorting equipment, tabulators, collators, and magnetic or punch-tape equipment. There may also be computer consoles that connect by telephone or other lines to a large centralized computer on the campus or even at other institutions. Computer consoles located in various buildings on the campus will be the most common way of providing computer services at large universities. Punch cards or tapes will not have to be transported across the campus with the use of this arrangement.

The installation of electronic computer equipment requires the installation of large electrical conduits, good ground connections, and oversized doors. A great deal of heat may be expected to be generated by the electronic equipment, individually controlled air conditioning equipment is necessary for maintaining the temperature required. Space should be provided to permit direct access to each piece of equipment for servicing. Since considerable noise is developed when data-processing equipment is in operation, acoustic treatment of ceiling and walls is essential. The division of the area into smaller rooms with soundproof wall helps reduce the noise problem.

Regional electronic library services are being planned for various locations in the United States. Provisions should be made for making use of this equipment.

Facilities for Research

The dark room, for obvious reasons, should not have an outside wall with a window. Therefore, good forced ventilation is essential. The room should be provided with running water, sinks, ample wall cupboards, and a generous supply of duplex electrical outlets (110v). The recommended room size is 225 square feet or more, with a 12-foot ceiling.

A number of researchers and teachers have need for graphic services for preparing materials for publication, for presentation at meetings, and for instruction. Camera equipment that can produce a 2 x 2 inch slide and overhead transparencies in a matter of a minute or two at little cost should be provided. Duplicating equipment may also be housed in this facility.

If the needs of the department are sufficiently large, a full-time or part-time person may be required to prepare graphic materials. A room used for this purpose should be well-lighted—a minimum of 80 footcandles is recommended—and should have large wall cupboards for storing drafting and some camera equipment. A room with a minimum of 400 square feet and a 10-foot ceiling height will provide sufficient space for the usual requirements of this facility.

Suggestions for Purchasing Equipment

The manufacture and sale of research equipment has become a very competitive business. As a result, there is frequently a wide range of the same kind of equipment available under different brand names. Before purchasing large expensive units, it is worth the time and effort to investigate carefully the various makes. The annual meetings of professional societies generally include exhibits by manufacturers of research equipment appropriate to the particular area of investigation. Consultation with a colleague in the same field who has used the equipment is a good idea before a purchase is made.

In considering particular pieces of equipment, the following determinations should be made: (a) if students are to use the equipment, or trained researchers; (b) initial and annual servicing cost; (c) if the equipment is electronically compatible with other equipment now in use or contemplated (often it is more economical to purchase units that match others from the same company so that the responsibility for servicing them rests with one company); (d) what power supply is needed; (e) ease with which the instrument may be calibrated, and if other equipment is needed for the calibration; (f) portability of the equipment; (g) what service the company is willing to provide and where the service centers are located; and (h) noise, vibration, and heat generated by the equipment. Unbiased answers to these and other questions can sometimes best be found by having discussions with other scientists who have used such installations.

Office Space

Individual offices for the various faculty members and graduate students involved in research should be convenient to the various laboratories. The installation of one or more rooms to be used for quiet work (e.g. calculating, reading and writing) is helpful.

Mobile Laboratory

In planning research facilities, serious thought should be given to the development of a mobile laboratory. The trend to eliminate laboratory schools makes the consideration of a mobile laboratory more urgent.

Trailers, campers, trucks, and other vehicles—even railroad cars—have been converted into mobile laboratories. Often the use of a field generator is necessary to provide current for operating mobile-laboratory equipment. It is surprising how much equipment can be compactly installed in a mobile facility.

Specific Laboratory Facilities

The information about laboratories listed in this section comprises only suggestions of how research facilities might be organized. Obviously, the character and organization of the institution itself will be an important factor in determining how facilities are to be organized and administered.

Measurement and Evaluation

Much of the so-called practical or applied research will be conducted in the gymnasium, swimming pool, and other indoor and outdoor activity areas. This means that in order to utilize measurement and evaluation equipment effectively, the regular activity areas must be planned and constructed in such a manner as to facilitate the conduct of research. For example, many skill tests are administered with the use of some type of wall volley as a part of a battery to measure skill in a certain activity. Therefore, it is important to construct the walls of a gymnasium so that present tests as well as those developed in the future may be utilized.

Consideration should be given to the attachment of special equipment to walls and ceilings, such as jump boards, ropes, and strength-measuring devices. Grids could be painted on the walls of the gymnasium as well as on the wall of a diving well in the swimming pool in order to measure distance and height when analyzing movement.

A great deal of the research equipment needs to be portable

so that it can be moved to the action areas. This means that proper electrical outlets and suitable acoustic treatment of these areas must be planned in advance.

These laboratories will contain the equipment that will be used at the elementary, junior high, and senior high school levels. Physical education teachers at these levels should be encouraged to make use of some of this equipment on the job.

Biomechanics (Kinesiology)

There are many areas in the field of biomechanics in which research may be conducted. The type of research may range from cinematography to human engineering. If there is a physiology of exercise laboratory available, experimentation may take place in which the equipment from this laboratory is used either jointly with the exercise physiologist or separately by the kinesiology researcher.

In cinematographic research (especially time lapse and high speed), a room 30 by 30 feet, with a ceiling height of at least 24 feet, is a necessity. High speed cameras whose frame rates vary from 64 to several thousand frames per second are

Figure 18
Space Needed for Selected Indoor Activities

Activity	Play Area in Feet	Safety Space in Feet*	Total Area in Feet	Minimum Ceiling Height
Archery	5x60	15e	5x75	12
Badminton	20x44	6s, 8e	32x60	24
Basketball				
Jr. High instructional	42x74	6s, 8e		24
Jr. High interscholastic	50x84	6s, 8e		
Sr. High interscholastic	50x84	6s, 8e	62x100	
Sr. High instructional	45x74	6s, 8e	57x90	
Neighborhood E. Sch.	42x74	6s, 8e	54x90	
Community Junior H.S.	50x84	6s, 8e	62x100	
Community Senior H.S.	50x84	6s, 8e	62x100	
Competitive - College & University	50x94	6s, 8e	62x110	
Boccie	18x62	3s, 9e	24x80	
Fencing, competitive	6x46	9s, 6e	18x52	
instructional	4x30	4s, 6e	12x42	12
Handball	20x40			20
Racquetball	20x40			20
Rifle (one pt.)	5x50	6 to 20e	5x70 min.	12
Shuffleboard	6x52	6s,2e	18x56	12
Squash	18.5x32			16 24
Tennis				
Deck (doubles	18x40	4s, 5e	26x50	
Hand	16x40	4½s, 10e	25x60	
Lawn (singles)	27x78	12s, 21e	51x120	
(doubles)	36x78	12s, 21e	60x120	
Paddle (singles)	16x44	6s, 8e	28x60	
(doubles)	20x44	6s, 8e	32x60	
Table (playing area)			9x31	24
Volleyball				
Competitive and adult	30x60	6s, 6e	42x72	
Junior High	30x50	6s, 6e	42x62	
Wrestling (competitive)	24x24	5s, 5e	36x36	

*Safety space at the side of an area is indicated by a number followed by "e" for end and "s" for side.

useful. Special film readers and projectors should be provided in order that accurate measurements may be made. Mirrors may be used to reflect images.

Equipment representative of the type used in the kind of laboratory includes:

- movement developing camera
- 35mm SLR camera
- high speed motion picture camera (motor-driven; 50-500 frames per second)
- stroboscopic equipment (including single and multi-flash units with strobolume and strobotac parts)
- force measuring devices (including individual strain gauges and multi-dimensional force plates)
- videotape recorder with two channels and playback capacity
- oscilloscope
- electronic counters
- amplifiers compatible with measuring and recording devices
- metal storage cabinets (approximately 18 inches deep by 36 inches wide) with locks

Special simulated game areas may be constructed so that a true picture of a performer in action may be studied. A miniature running track may be developed, as well as other similar replicas of playing areas. Nets and other devices may need to be used to catch objects or to prevent them from traversing the customary distance.

Human Performance Laboratory

An area of at least 40 by 40 feet, providing a minimum of 1,600 square feet of space, should be provided for the exercise room for human beings.

The most popular methods of standardizing exercise in human beings are a) by means of a motor-driven treadmill, bicycle, or other ergometer; and b) step tests of various kinds. The exercise room should be large enough to accommodate all the needed equipment. There should be space for several technicians as well as for scientific instruments (e.g. a Tissot tank).

Since some noise and vibration result when the treadmill is operating—and some treadmills are quite heavy—it is well to locate this room on the ground floor, with provisions for reducing noise. The treadmill should be installed in a pit (and even on a pad to help further reduce noise), if possible, with space in the pit for servicing.

The room should be air-conditioned, with control over temperature within a plus or minus 1½ degrees Fahrenheit and control over humidity of plus or minus 5 percent. Electric current (110v and 220v) should be supplied through numerous outlets. A large thermopane observation window should also be installed.

A room 20 by 25 feet with a ceiling height of 12 feet to allow for walking, running, or riding a bicycle up a grade on the treadmill, is generally sufficient. If the treadmill is not installed in a pit, the ceiling may have to be higher. It is usually desirable to have connecting cables, including voice communication, to a space adjoining the exercise room so desirable data can be recorded outside the room. An alternate method of constructing a platform surrounding the treadmill may be more practical. The kinds of equipment found in the exercise room, in addition to exercising apparatus, might include the following:

- multichannel recorder
- tape recorder (multichannel)
- gas meters
- cot
- rectal probe
- spirometer
- telemetering apparatus
- electronic gas analyzers
- Douglas or meteorological bags
- barometer
- thermocouples
- tissot tank(s)

Analytical Rooms. The number of analytical rooms will depend upon the extent of the research being conducted and the number of investigators involved. These rooms should each be a minimum of 20 by 20 feet, with a ceiling height of 10 feet. They should be air-conditioned and contain the benches, cabinets, sinks, fume hoods, and air, gas, and electrical-current supplies usually found in laboratories of this type. The typical kinds of equipment used in these rooms include chemical gas analyzer, pH meter, analytical balance, still, spectrophotometer, refrigerator or freezer, titrator, osometer, microscope, autoclave, glassware, Bunsen burner , and desk calculator.

Additional Facilities. In many departments, additional major facilities may be required. Because research in exercise physiology is closely related to research in environmental physiology and nutrition, the following facilities may be needed:

- Barometric chamber (with space for controlled exercise)
- Hot room (with space for controlled exercise)
- Cold room (with space for controlled exercise)
- Diet kitchen
- Flow-through water tank for studying energy metabolism during swimming and rowing
- Isotope storage, handling, and counting equipment

In addition, animal exercise and housing rooms may be considered.

Motor Learning and Psychology of Sports

Much of the research equipment found in psychology, physiology of exercise, and kinesiology (biomechanics) laboratories can be used in research in motor learning and psychology of sports. However, it is necessary to have a separate room or facility, at least 30 by 30 feet, with a 12-foot ceiling.

The arrangement of the equipment in the room will depend on the research underway at the moment. In any event, the electrical devices used should not be constantly moved or they will become unusable.

Some equipment that might be included in a laboratory for research in motor learning and psychology of sports includes:

Multichannel recorders, standard electric clocks, interval timer, steadiness units, muscle stimulator, electronic counters, variable power supply, electronic kits, audio amplifiers, microphone, audio oscillator, oscilloscope, telemetry transmitter, telemetry receiver, voltage stabilizer, battery charger, seashore test, magnetic tape recorder and storage cabinets (metal, with locks).

Research and Testing Laboratories

Safety Education

Many institutions have special facilities for research in safety education. Some recommended facilities and equipment items are as follows:

- Simulator laboratory (600 square feet)

Aetna Drivotrainer
AAA auto trainer
Driver trainer

- Psychophysical testing laboratory (720 square feet) for testing—visual acuity, distance judgement, field of vision, color vision, night vision, glare vision, glare recovery, reaction time, steadiness.
- Safety Education Laboratory (500 square feet) Equipment for testing—protective devices for industrial accident prevention, protective devices for use in physical education, athletics, and recreation. Multiple-car off-street driving range (at least 350 by 450 feet)

History and Sociology of Sports

Little in the way of special facilities is recommended for research in the history and sociology of sports. In addition to office space, research workers in this area might require rooms for the storage and use of manuscripts, rare books, tapes and videotape collections. Reproducing equipment and microcard or microfilm readers might also be needed.

Recreation

The research facilities of other disciplines, such as those of psychology and sociology, should be made available for use by recreation department personnel. However, it is recommended that a special camp site, where experimentation with human subjects may be conducted, be developed by the college or university. Studies of plant life and soil conditions may also be made at such camp facilities.

Computer facilities could be utilized by the graduate students and faculty of the recreation department. Therapeutic recreation researchers may find it possible to utilize facilities of medical schools as well as those of state and local hospitals. The establishment of model community centers and playgrounds on the campus should provide ideal settings for research being conducted on leadership and program problems.

Summary

Careful planning of facility space to support research is essential and will often pay dividends in terms of increased faculty research production. Individuals planning for these areas are encouraged to visit working laboratories to examine space relationships, functional programming, types of equipment, and the overall strengths and weaknesses of each layout. Input from the faculty members to be involved in "operating" the laboratories needs to be solicited.

Indoor Community Areas

Information concerning the planning of general recreational buildings such as a community center and specialized recreational buildings (i.e. art center, preschool center, senior citizen center, teen center, etc.) available in Chapter 7.

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Check List for Facility Planners Relating to General Indoor Facility Features

As an aid to those responsible for planning facilities for athletics, physical education, and recreation, a check list has been prepared. The application of this check list may prevent unfortunate and costly errors.

General

1. A clear-cut statement has been prepared on the nature and scope of the program, and the special requirements for space, equipment, fixtures, and facilities have been dictated by the activities to be conducted. _____
2. The facility has been planned to meet the total requirements of the program as well as the special needs of those who are to be served. _____
3. The plans and specifications have been checked by all governmental agencies (city, county, and state) whose approval is required by law. _____
4. Plans for areas and facilities conform to state and local regulations and to accepted standards and practices. _____
5. The areas and facilities planned make possible the programs that serve the interests and needs of all the people. _____
6. Every available source of property or funds has been explored, evaluated, and utilized whenever appropriate. _____
7. All interested persons and organizations concerned with the facility have had an opportunity to share in its planning (professional educators, users, consultants, administrators, engineers, architects, program specialists, building managers, and builder — a team approach. _____
8. The facility will fulfill the maximum demands of the program. The program has not been curtailed to fit the facility. _____
9. The facility has been functionally planned to meet the present and anticipated needs of specific programs, situations, and publics. _____
10. Future additions are included in present plans to permit economy of construction. _____
11. Lecture classrooms are isolated from distracting noises. _____
12. Storage areas for indoor and outdoor equipment are of adequate size. They are located adjacent to the gymnasiums. _____
13. Shelves in storage rooms are slanted toward the wall. _____
14. All passageways are free of obstructions; fixtures are recessed. _____
15. Facilities for health services and the first-aid and emergency-isolation rooms are suitably interrelated. _____
16. Buildings, specific areas, and facilities are clearly identified. _____
17. Locker rooms are arranged for ease of supervision. _____
18. Offices, teaching stations, and service facilities are properly interrelated. _____
19. Special needs of the physically handicapped are met, including a ramp into the building at a major entrance. _____
20. All "dead space" is used. _____
21. The building is compatible in design and comparable in quality and accommodation to other campus structures. _____
22. Storage rooms are accessible to the play area. _____

23. Workrooms, conference rooms, and staff and administrative offices are interrelated. _____
24. Shower and dressing facilities are provided for professional staff members and are conveniently located. _____
25. Thought and attention have been given to making facilities and equipment as durable and vandalproof as possible. _____
26. Low-cost maintenance features have been considered. _____
27. This facility is a part of a well-integrated master plan. _____
28. All areas, courts, facilities, equipment, climate control, security, etc., conform rigidly to detailed standards and specifications. _____
29. Shelves are recessed and mirrors are supplied in appropriate places in rest rooms and dressing rooms. _____
30. Dressing space between locker rows is adjusted to the size and age of students. _____
31. Drinking fountains are conveniently placed in locker room areas or immediately adjacent thereto. _____
32. Special attention is given to provision for locking service windows and counters, supply bins, carts, shelves, and racks. _____
33. Provision is made for repair, maintenance, replacement, and off season storage of equipment and uniforms. _____
34. A well-defined program for laundering and cleaning towels, uniforms, and equipment is included in the plan. _____
35. Noncorrosive metal is used in dressing, drying, and shower areas except for enameled lockers. _____
36. Antipanic hardware is used where required by fire regulations. _____
37. Properly placed hose bibbs and drains are sufficient in size and quantity to permit flushing the entire area with a water hose. _____
38. A water resistant, covered base is used under the locker base and floor mat and where floor and wall join. _____
39. Chalkboards and/or tackboards with map tracks are located in appropriate places in dressing rooms, hallways, and classrooms. _____
40. Book shelves are provided in toilet areas. _____
41. Space and equipment are planned in accordance with the types and number of enrollees. _____
42. Basement rooms, undesirable for dressing, drying, and showering, are not planned for those purposes. _____
43. Spectator seating (permanent) in areas that are basically instructional is kept at a minimum. Roll away bleachers are used primarily. Balcony seating is considered as a possibility. _____
44. Well-lighted and effectively displayed trophy cases enhance the interest and beauty of the lobby. _____
45. The space under the stairs is used for storage. _____
46. Department heads' offices are located near the central administrative office which includes a well-planned conference room. _____
47. Workrooms are located near the central office and serve as a repository for departmental materials and records. _____
48. Conference area includes a cloak room, lavatory, and toilet. _____
49. In addition to regular secretarial offices established in the central and department chairmen's offices, a special room to house a secretarial pool for staff members is provided. _____
50. Staff dressing facilities are provided. These facilities may also serve game officials. _____
51. The community and/or neighborhood has a "round table" for planning. _____
52. All those (persons and agencies) who should be a party to planning and development are invited and actively engaged in the planning process. _____
53. Space and area relationships are important. They have been carefully considered. _____
54. Both long-range and immediate plans have been made. _____
55. The body comfort of the child, a major factor in securing maximum learning, has been considered in the plans. _____
56. Plans for quiet areas have been made. _____
57. In the planning, consideration has been given to the need for adequate recreational areas and facilities, both near and distant from the homes of people. _____
58. Plans recognize the primary function of recreation as being enrichment of learning through creative self-expression, self-enhancement, and the achievement of self-potential. _____
59. Every effort has been exercised to eliminate hazards. _____
60. The installation of low-hanging door closers, light fixtures, signs, and other objects in traffice areas has been avoided. _____
61. Warning signals—both visible and audible—are included in the plans. _____
62. Ramps have a slope equal to or greater than a one-foot rise in 12-feet. _____
63. Minimum landings for ramps are 5 by 5 feet, they extend at least one foot beyond the swinging arc of a door, have at least a six-foot clearance at the bottom, and have level platforms at 30-foot intervals on every turn. _____
64. Adequate locker and dressing spaces are provided. _____
65. The design of dressing, drying, and shower areas reduces foot traffic to a minimum and establishes clean, dry aisles for bare feet. _____
66. Teaching stations are properly related to service facilities. _____
67. Toilet facilities are adequate in number. They are located to serve all groups for which provisions are made. _____
68. Mail services, outgoing and incoming, are included in the plans. _____
69. Hallways, ramps, doorways, and elevators are designed to permit equipment to be moved easily and quickly. _____
70. A keying design suited to administrative and instructional needs is planned. _____
71. Toilets used by large groups have circulating (in and out) entrances and exits. _____

Climate Control

1. Provision is made throughout the building for

climate control—heating, ventilating, and refrigerated cooling. _____

2. Special ventilation is provided for locker, dressing, shower, drying and toilet rooms. _____

3. Heating plans permit both area and individual room control. _____

4. Research areas where small animals are kept and where chemicals are used have been provided with special ventilating equipment. _____

5. The heating and ventilating of the wrestling gymnasium have been given special attention. _____

Electrical

1. Shielded, vapor-proof lights are used in moisture prevalent areas. _____

2. Lights in strategic areas are key-controlled. _____

3. Lighting intensity conforms to approved standards. _____

4. An adequate number of electrical outlets are strategically placed. _____

5. Gymnasium and auditorium lights are controlled by dimmer units. _____

6. Locker room lights are mounted above the space between lockers. _____

7. Natural light is controlled properly for purposes of visual aids and avoidance of glare. _____

8. Electrical outlet plates are installed three feet above the floor unless special use dictates other locations. _____

9. Controls for light switches and projection equipment are suitably located and interrelated. _____

10. All lights are shielded. Special protection is provided in gymnasiums, court areas, and shower rooms. _____

11. Lights are placed to shine between rows of lockers. _____

Walls

1. Movable and folding partitions are power-operated and controlled by keyed switches. _____

2. Wall plates are located where needed and are firmly attached. _____

3. Hooks and rings for nets are placed (and recessed in walls) according to court locations and net heights. _____

4. Materials that clean easily and are impervious to moisture are used where moisture is prevalent. _____

5. Shower heads are placed at different heights—four feet (elementary) to seven feet (university) for each school level. _____

6. Protective matting is placed permanently on the walls in the wrestling room at the ends of basketball courts, and in other areas where such protection is needed. _____

7. An adequate number of drinking fountains are provided. They are properly placed (recessed in wall). _____

8. One wall (at least) of the dance studio has full length mirrors. _____

9. All corners in locker rooms are rounded. _____

Ceilings

1. Overhead supported apparatus is secured to beams engineered to withstand stress. _____

2. The ceiling height is adequate for the activities to be housed. _____

3. Acoustical materials impervious to moisture are used in moisture prevalent areas. _____

4. Skylights in gymnasiums, being impractical, are seldom used because of problems in waterproofing roofs and the controlling of sun rays. _____

5. All ceilings except those in storage areas are acoustically treated with sound-absorbent materials. _____

Floors

1. Floor plates are placed where needed and are flush-mounted. _____

2. Floor design and materials conform to recommended standards and specifications. _____

3. Lines and markings are painted on floors before sealing is completed (when synthetic tape is not used). _____

4. A coved base (around lockers and where wall and floor meet) of the same water resistant material used on floors is found in all dressing and shower rooms. _____

5. Abrasive, nonskid, slip-resistant flooring that is impervious to moisture is provided on all areas where water is used—laundry, swimming pools, shower, dressing, and drying rooms. _____

6. Floor drains are properly located, and the slope of the floor is adequate for rapid drainage. _____

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See annotated bibliography in Appendix for related articles.

III. Outdoor Facilities

Outdoor Facilities

OUTDOOR FACILITY NEEDS are determined by desired programming. While this chapter includes materials pertaining primarily to outdoor facilities serving athletic and physical education activities, Chapter 7 is devoted to a discussion of recreational related facilities.

In recent years, numerous events have occurred supporting the need for additional outdoor facilities. These include: an increased interest in physical activity, demand for a greater variety of activities in physical education and athletic programs and increased support for women's interscholastic and intercollegiate programs influenced by Title IX legislation. These developments and others, have combined to create an acute shortage of outdoor facilities for most educational institutions and recreational organizations across the United States.

Ideally, one would have an opportunity to develop a master plan for outdoor physical education and athletic facilities for a new school or a new recreation site. This would enable the planner to think in terms of locating a variety of specific facilities for most effective use. The location of outdoor facilities in relation to each other, to indoor areas and associated buildings, and to the people who will use them, is important in evaluating both the short term and long term usefulness. However, in many instances, facility planners must develop plans in relation to previously constructed facilities. In this situation, planning opportunities are restricted; although the possibility usually exists for architectual creativity.

This chapter has been written and illustrated to aid planners in their efforts to create the most functional out-of-doors facilities possible. General features common to all outdoor facilities as well as features specific to certain activities are covered.

General Considerations in Site Selection

Facilities or areas should be planned to accommodate the activity. The activity is determined by the program purposes and upon the interests, needs, and capacities of the participants. The following criteria are important in determining specific activities and the areas necessary for their successful conduct: (1) adaptability (capable of being used appropriately in given situations); (2) seasonableness (relevance to weather and seasons in a geographic area); and (3) progression (a part of the total program and leading sequentially to other skills and activities).

The following factors then must be considered: (1) the number of learners or participants for any single space and for the total area in a given time span; (2) the number of spectators for any single space and for the total area; (3) the special relationships of each area; (4) the movement patterns of participants, learners, and spectators; (5) the interrelationships of curricular and extra-curricular activities and of combined curricular and extra-curricular activities; (6) the priority ranking of each space; (7) the equipment necessary for each space; (8) the environmental conditions for each space; (9) the projected future expansion of the facility; and (10) the predicted changes in programs and activities.

Areas developed for physical education, athletics and recreation often are the largest on any campus. Space is essential to permit creative design ideas. Whenever possible, care should be taken to avoid locating a facility on a site that restricts design options and, as a consequence, interferes with achieving the ideal program objective. Because of the size and nature of these areas, attention should be given to aesthetic qualities and compatability with surrounding structures and areas.

Specific Considerations in Site Selection

Most outdoor physical education activities require a level play area. Sites that have irregular surfaces, extensive brush and tree growths, and numerous large rocks and other obstructions are difficult and expensive to prepare for athletic fields. Some of these characteristics can be useful in the development of certain kinds of facilities. As an example,

they are essential for outdoor education activities and/or quiet areas. Trees also act as wind breaks, provide shade, and aid in noise absorption.

Sound planning also takes into account the shape as well as size of site to be developed. Care should be exercised with regard to orientation of the facility or area with the sun. Most outdoor sports areas should have their longitudinal axis approximately north and south. Grading and filling are extremely expensive, but fill from campus building construction can frequently be used to raise sports field to a more appropriate level.

Good drainage is important. Physical activity areas that are temporarily flooded after rains obviously will not afford maximum use, nor will sites that drain slowly. Sandy soils offer excellent drainage; a clay base will require the installation of engineered draining. Rich topsoil will enhance planting and and landscaping. Areas with extensive subsurface rock formations are expensive to grade, and inhibit the growth of other vegetation necessary for the absorption of water.

Listed below are a number of other important factors which merit careful consideration in selecting a site:

Accessibility. The site selected for the development of physical education and athletic fields should be easily accessible.

Isolation. Outdoor physical education and athletic facilities should be isolated from persistent and unnecessary distractions. Conversely, these facilities should be located so their use does not become a distraction for nearby classrooms and living units.

Integration. Outdoor facilities should be located strategically in relation to one another and to other accommodating facilities.

Adaptability. A site for outdoor facilities should combine qualities of permanence with those of flexibility. These facilities should be located and designed in such a way as to permit ease and economy in bringing about the alterations and changes that future requirements may demand.

Expansibility. Plans for long-term efficient use of field areas should anticipate the possibility of changes in the program through the years. In planning for these eventualities, it is necessary to locate field and court areas on site which are somewhat larger than minimum requirements demand. It is also important that goal net posts, backstops, and other fixtures be planned in such a way as to permit rearrangement when necessary. In addition, attention should be given to the multipurpose use of facilities.

Safety Factors in Site

The first aspect of safety in selecting sites for physical education is to have adequate acreage in order to provide for safety in locating areas of activity. A planner should never increase the risk of potential injury to students by using all available space for activity areas and sacrificing area for safety. Before thinking quantity, think safety.

Traffic safety around activity areas is the most important factor to be considered in selecting sites. Outdoor play areas should be located so there is no interference with the traffic of pedestrians, buses, automobiles, service vehicles and bicycles. Driveways should be planned to give direct access to parking areas, and should normally not bisect or parallel play areas. If the condition demands that areas be bisected or paralleled, fencing should be installed to separate the play areas from the traffic pathway. This will prevent loose balls from entering the pathway and prevent students from wandering into the traffic. Adequate driveways within the school area also provide easy access to areas for emergency vehicles.

Walkways should provide direct access between areas and facilities. However, care should be taken to prevent interference with activities or the creation of a safety hazard. This restriction will protect both pedestrians and participants from injury.

Different play areas used by different age groups should be isolated. Shrubbery hedges, trees, fences, concrete walls, or even buildings have proven to be effective barriers. It is important that these areas be separated because different age groups play different games at different levels of intensity. With a high school soccer field located next to an elementary playground, an errantly kicked ball chased by a student into the playground area full of elementary children could result in serious injury. This possibility could be easily prevented if the field and playground has some type of divider to isolate the areas. (Figure 1).

Due to the obvious danger, any and all types of play areas should not be placed alongside railroads or open water. However, a high chain link fence can be installed to separate the play area if such location cannot be avoided.

Present and future environment conditions should be taken into consideration when selecting sites for areas of activity. Locating outdoor activity areas adjacent to an industrial site is not desirable. Being close to such an environment causes unnecessary distractions during class periods. Another hazard of industry close to activity areas is the factor of prevailing winds blowing pollutants over the fields. In southern

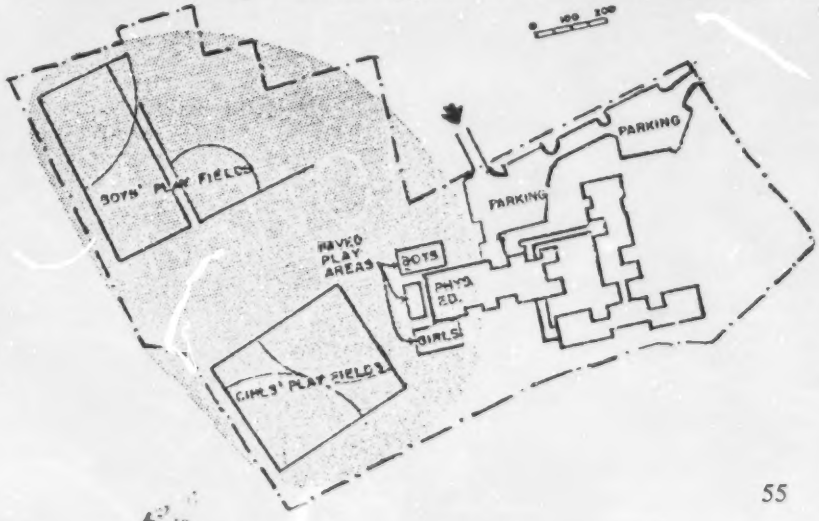


Figure 1

The plan of the Ulloa Elementary School in San Francisco, Calif. indicates a possible solution when the land available for play areas is very limited. Traffic hazards have been reduced by placing the building along two of the surrounding streets and providing walls, fences, and shrubbery along the other streets to separate traffic from children. Safety is provided inside the play areas by placing a serpentine wall between primary and intermediate children. The building is used as another barrier for kindergarten play.

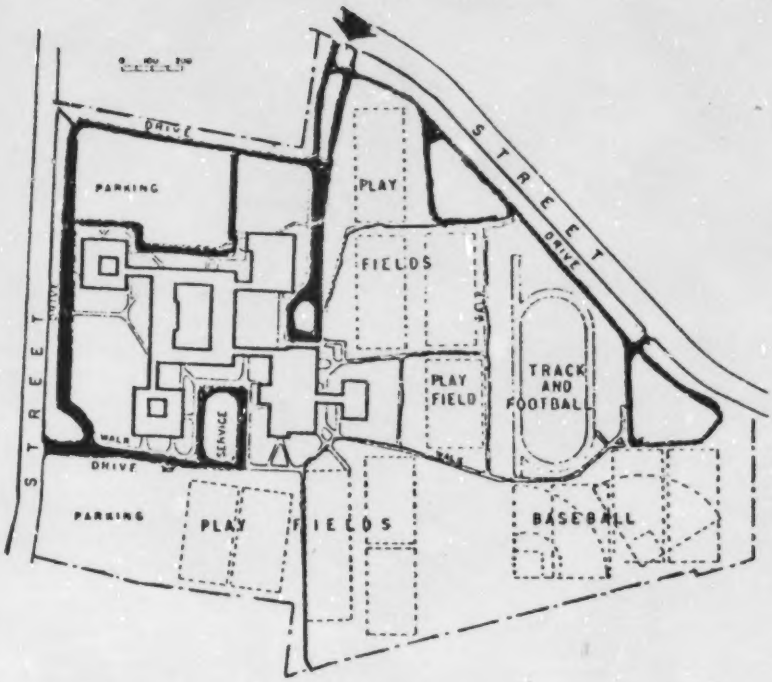


Figure 2
Location of Playing Fields

The architects have utilized a high percentage of the total land area at the White Plains (N.Y.) High School. The gymnasium location provides for spectator parking, direct access to playfields, and noise control between the high and low noise levels of the plant. Walkways to the different playfields permit students to move from field to field, or field to gym, without interrupting other activities. The number and variety of play areas give the physical education program balance, flexibility, and completeness, and also provide better facilities for community activity.

California students sometime cannot safely participate outside due to smog generated by industry.

Activity areas should never be placed near utility wires or poles of any kind. There should not be excessive trenching for water drainage without protective barriers. Sewage areas should be placed well away from activity areas and gas lines should not run under areas of play. Utilities of any kind are potentially dangerous around activity areas and never should be close to or encroach upon a play area.

All play fields (not varsity fields) should be located well away from driveways, roads or parking lots. School play areas should be close to the school, directly accessible from both the boys' and girls' locker rooms. Areas involving varsity sports can be placed on the outer edges of the school property and along driveways and parking lots providing there is adequate fencing surrounding the areas. Being placed along the driveway or next to the parking lot provides easy accessability for proper entrance and exit of spectator vehicles. If an athletic event takes place during school hours, the event will not disrupt other classes. (Figures 2 and 3).

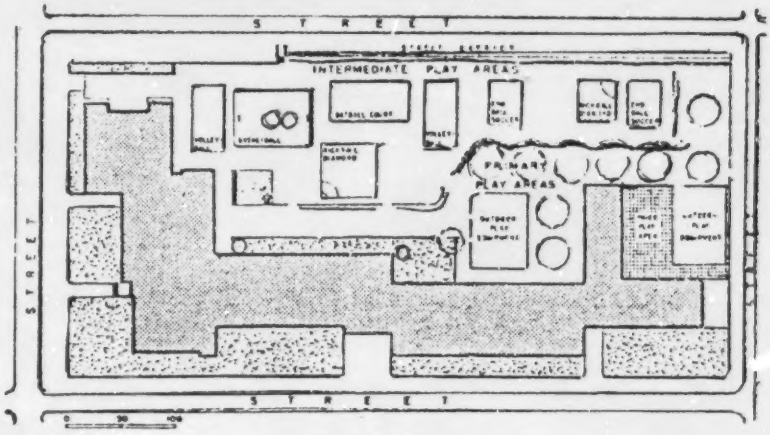
Another important consideration is security. It would be advantageous to place facilities and storage areas in places that are well lighted and easily observed. This can be effective in deterring possible vandalism and theft.

Field Space

It is obviously important to designate the kinds of activities to be included in a program and the functional features needed to serve those activities. It is equally important to consider all available factors which indicate the number of facility or area units needed for each activity. Sufficient

Figure 3
Location of Playing Fields

In the site plan of the North Shore Junior High School, Glen Head, N.Y. skillful use has been made of an irregular-shaped site. Roadways and parking areas are located away from the classrooms. Several hard-surface play areas are situated near the gymnasium to give flexibility in scheduling activities and more outdoor play time. The size of the site is adequate for future expansion of activities.



quantity is met when peak load participation is achieved under actual conditions of use.

In planning facilities, local initiative and ingenuity should be encouraged. The athletic, physical education, and recreation programs of a community should be developed to accommodate the needs and stimulate the interests of the specific people who are to be served by those programs.

Factors that influence participation and are directly related to any realistic estimates of future peak load participation are: (1) the maximum number of individuals for whom facilities are being provided, (2) the physical education curricular requirements, if any, including the number of years required, the number of semester/quarter hours required, the number of periods required each week, length of each period, maximum and desired size of each class, activities to be included, and plans for coed activity, (3) the emphasis on voluntary programs such as extra-curriculars and elective offerings as well as recreational activities, (4) the nature of additional long-term institutional policies which influence the degree of success to be logically anticipated in the various aspects of the physical education program, and (5) the availability of acceptable facilities belonging to other organizations and prospects for the joint use of such facilities.

In estimating facility needs, it is more desirable to err on the side of too much-too soon than too little-too late.

Elementary and Secondary School Outdoor Facilities (Special Considerations)

Neighborhood Park-School (Elementary)

The neighborhood park-school is the primary area in planning for education and recreation. It is a combination of a neighborhood elementary school and playground. It is planned in such a manner that all areas and facilities are used to meet the educational and recreational interests and needs of the people living in a neighborhood. It is essential that areas and facilities be cooperatively planned for the dual purpose of instruction and recreation and that the school and community recreational programs be coordinated for maximum use by the entire neighborhood.

The neighborhood park-school should service an area with a maximum zone of one-half mile and a population of approximately 4,000 to 8,000 people. Any deviation in the population density (larger or smaller communities) may mean a change in needs or interests and thus may alter the service radius and/or acreage required for this installation.

The minimum area recommended for a neighborhood park-school is 10 to 30 acres.

As an illustration, this area might be developed as follows:

	Acres
School Building	2.0 - 3.0
Parking	1.0 - 1.5
Playlot and apparatus	1.0 - 1.5
Hard-surface game courts and multi-use area	1.0 - 2.5
Turf-games field	4.5 - 5.5
Park area, including space for drama and quiet activities	3.0 - 5.5
Buffer zones and circulation	2.0 - 3.0
Recreation service building	0.2 - 0.5
Corner for senior citizens	0.3 - 1.0
Total	10.3 -30.0

Community Park-School (Secondary)

The community park-school is an area in which are located a junior or senior high school and a variety of recreational and physical education facilities designed for both school and community use. It should be centrally located in the community and provide a parklike environment. If it contains a senior high school, it requires more acreage than if it is associated with an elementary or junior high school, and its service radius is appreciably greater.

Many people using such centers reach them by automobile or public transport. Relatively few live close enough to walk to them. A portion of the area is usually developed as a playground for the children living in the immediate neighborhood, while another portion serves as a landscaped park.

The function of this area is similar to that of the neighborhood park-school. While the neighborhood park-school contains an elementary school and serves primarily children, the community park-school contains a secondary school and serves primarily young people and adults. The geographic area served by the community school is larger (usually consisting of three or more residential neighborhoods). Its space requirements are much greater, and it provides facilities not feasible in the neighborhood unit because of the cost and needed space. The community park-school with a senior high school needs more area in order to provide for scholastic athletics, spectator space, and extensive parking.

In communities where the park-school plan cannot be put into effect, separate sites are required for the secondary schools—the junior and senior high schools. A smaller site will serve the needs of the school physical education, recreation, and outdoor education programs better than if the area were also expected to provide the recreational service for the entire community.

The senior high school needs a larger site than the junior high school because the enrollment is usually higher and because of the greater space requirements of the interscholastic athletic program. Even though separate public indoor and outdoor recreational facilities are provided elsewhere in the community, the junior and senior high school plants should be designed to facilitate community use when they are not required for school purposes.

One example of close cooperation between a municipality and the public school system is the installation of municipal tennis courts on school property. The municipality's recreation budget supports the cost of court installation while the school provides the land. The school retains priority for use during school hours and the courts are available for community use after school hours and on week-ends.

Orientation of Areas

Courts and fields should be oriented to give protection to both players and spectators. It may not be possible to get the best orientation of a particular court or field because such factors as topography, shape of the area, and location of other facilities may dictate variations.

Outdoor courts and fields should be oriented so players will not have to face into the late-afternoon or early-morning sun. In rectangular fields and courts, the long axis should generally be at right angles to the late-afternoon sun's rays. Locate the sunset position at midseason of the sport and orient the field or court accordingly.

On baseball, softball, and similar fields, the general pattern of the ball's flight covers an arc of more than 90 degrees. Since the field cannot be oriented to give equal protection to

all players and spectators, a choice must be made. Because the batter, pitcher and catcher are in the most hazardous positions, they should be given first consideration. A line through these positions should be the axis for orienting the field.

Site Development

Problems which are commonly present in site-development projects are concerned with grading, drainage, landscape design, fencing, and accessibility to water and electricity.

Grading

Outdoor physical education and sports activities are best promoted on field and court areas that are relatively level. However, the topography of available sites and the cost of filling and grading often make some terracing necessary.

Drainage

It is always necessary to provide for a gradual slope of all playing sites to assure the efficient removal of excess surface water. A one-percent slope is recommended as maximum for turf areas. For a stadium football field, a 12-inch crown down the longitudinal axis on the middle of the field is recommended.

For baseball, the pitcher's box should be elevated 10 inches above the base lines and home plate. The slope from the pitcher's box to home plate and to all base lines should be gradual. A one-percent drainage grade for the outfield is recommended.

Large, hard-surface, multipurpose areas are generally sloped so that surface water is directed toward specific collection points. It is recommended that for tennis, volleyball, badminton, and other net games the slope be from one side of the court to the other.

A widely accepted standard for the finished grade for hard-surfaced court areas calls for a slope of one inch in eight feet, as a means of providing adequate surface drainage. A few experienced tennis court contractors can flatten this somewhat to one inch in ten feet.

Attention should be given to the problem of subsurface drainage in the development of playing fields. This problem is generally peculiar to local conditions, and consultation with a competent soils engineer is recommended. Due to the hazards of damage from freezing, subsurface drainage is also an important consideration in the construction of hard-surface court areas.

Landscape Design

Landscaping should be planned so as to improve the playing conditions. Shrubs, hedges, trees, and vines can be used as windbreaks, background barriers, spectator screens and ground cover. They also enhance the value of adjacent property and provide a better environment for the enjoyment of the activity.

An important duty of the landscape engineer is to provide proper and well-designed entrance and exit walks, drives, and parking areas for all playing areas.

Plans and specifications for landscape plantings should be prepared at the same time as those for the original site development. This will ensure that the plantings will be in keeping with the total development.

Water and Electricity

No turf playing area can be properly developed or maintained without an adequate water supply. Therefore, in designing a field area, it is recommended that an automatic sprinkler system be installed to reduce field maintenance.

Electrical outlets should be available at all field and court areas. The number, size, and voltage should be determined by the requirements of field lights, public-address systems, concession facilities, scoreboards, and maintenance equipment.

Consideration should always be given to the location of a telephone at all field and court areas. This is a safety precaution for emergencies, an aid and important time-saver for maintenance help, and a convenience for players and spectators.

Fencing

Fencing is frequently required for many physical education and sports areas for security, safety, isolation, enclosure, separation, noise abatement, wind screening, sun screening, traffic control (pedestrian and vehicular), and for the protection of participants, the general public, spectators, and property.

In the case of baseball, field hockey, softball, soccer, rugby, lacrosse, and tennis, fences are used to confine the ball to the playing area, and thus enhance the play of the game and the enjoyment of spectators. Unfenced baseball and softball fields reduce the home-run potential.

In lacrosse, field hockey, soccer, and rugby, a fence three feet beyond the end line of the playing field confines most out-of-bounds balls and reduces time lost in retrieving the ball. A 10 to 12-foot fence on all sides of tennis courts is recommended to confine balls and speed up play.

Some characteristics of good fencing are stability, durability, economy of maintenance, attractiveness, and effectiveness. Among the many types of suitable fencing avialable, woven wire fencing of the chain-link type (minimum thickness—11 gauge), using H type or circular line posts, meets requirements satisfactorily. Chain-link fencing is available in the standard galvanized steel and also in aluminum-coated steel, plastic-coated steel and aluminum alloy mesh. The new plastic coatings are smoother to the touch and come in a variety of colors. Forest green is the most common color since it blends well with grass and shrubs. The appearance, security and isolation qualities of the chain-link fence can be enhanced with the insertion of wood, metal or plastic strips into the fencing. The most commonly used insertion is redwood strips woven vertically.

All chain-link fencing should be installed with the smooth edges at the top. In special cases, however, it may be desirable to have smooth edges at both top and bottom. A hard-surface mowing strip about 12 inches wide may be placed under the fence to facilitate maintenance. To prevent balls from rolling under the fence (such as in a baseball facility) redwood or pressure-treated boards may be attached to the bottom of the fence if it does not reach to the mowing strip.

The pool and deck area of outdoor pool installations must be completely enclosed by a fence at least seven feet high. Local and state codes should be consulted. The bathhouse should be located on the side of the prevailing wind. If not, it is recommended that a wall or wind-breaking fence be installed on the windward side. Chain-link fencing with redwood or plastic inserts may be used here as well as on the other side for privacy. The use of grass berms or fence line

plantings or planters is also recommended for aesthetic purposes. This fence is a safety feature for those using the pool as well as contributing to the maintenance of proper control of the facility. The wading pool, or play pool, and space for smaller children, which may be located immediately adjacent to the swimming area, should be separated from it by a fence and gate.

The most common material used for fencing of tennis courts is chain-link fabric. The forest green plastic coating is increasing in popularity. This fencing should have a minimum height of 12 feet along the rear lines of the courts and a minimum of 10 feet on the sides. The courts should be entirely enclosed. Where cost is a major factor, the fencing may be placed along the rear of the courts, with a 20-foot wing return on the sides. The fence fabric should be placed on the inside of the fence posts. Canvas or plastic wind screens, or redwood, plastic or metal inserts should be installed on the windward side.

Rebound walls are recommended. They should be 12 feet in height topped by 3 feet of light fencing to reduce the number of lost balls. These walls should be located on the north end of the courts so the players are not facing the sun and so the wall's shadow does not fall on the court where it would delay the drying of overnight moisture. Entrance gates should be located at the ends of the courts in order to reduce cross-court traffic. A gate at each end between each pair of courts is recommended.

Where admission is charged, a fence with a minimum height of seven feet surrounding the spectator structure and the enclosed field is essential. Landscape architects often use vines, shrubs or other plantings along fences to create an attractive appearance. Gates are necessary for spectator and service entrances and exits. Admission gates should be located near the parking lots and other main approaches to the structure including public transportation stops. The number and size of the entrances depend on anticipated present and future attendance. Exits should permit the crowd to vacate the enclosure in ten minutes. Twenty-two inches of linear exit space should be provided for each 500 spectators. At least one gate 14 feet high and 14 feet wide should be provided to accommodate trucks and buses.

Walkways

All-weather walks should be confined to a minimum in open play areas and should be provided only where the foot traffic is heavy enough to warrant. Circulation walks serve as guideways to interesting features and may be of many kinds of surfacing material such as concrete, asphalt, brick, adobe, exposed aggregate concrete, loose aggregate, tile, stone or wood. Basic considerations in the choice of surface type include: intended use, cost, ease of installation, durability, appearance and maintenance. Portland cement and asphalt best meet the requirements of heavily trafficked areas.

The walks should vary in width in consonance with the traffic density and should not cross through game courts or areas. To accomplish the desired circulation of traffic, it may be necessary to use signs, pavement lines and fixed or planted barriers. The degree of slope, and subsurface drainage should be given careful consideration. Drainage tiles may be used if necessary.

In developments where it is impractical to service features and facilities with drives, or from adjacent street pavements, selected walks should be of heavier construction and of sufficient width to accommodate service-truck loads.

Surfacing

There is no one surface which will satisfactorily meet the needs of all outdoor activities. Each activity has its own surface requirements, which will dictate what type, or types, of material can be used.

In the selection of surfacing material for any outdoor area, certain qualities should be sought, including multiplicity of use, durability, dustless and stainless, reasonable initial cost and economy, ease of maintenance, pleasing appearance, nonabrasiveness, resiliency and year-round usage.

Obtaining the proper surface for outdoor areas continues to be a perplexing problem. Over the years, however, there have been significant developments in surfacing. The various types of surfacing materials are shown in the accompanying table.

Types of Surfacing Materials

Group	Type
Earth	Loams, sand, sand-clay, clay-gravel, fuller's earth, stabilized earth, soil-cement.
Turf	Bluegrass mixtures, bent, fescue, Bermuda.
Aggregates	Gravel, graded stone, graded slag, shell, cinders.
Asphalt	Penetration-macadam, asphaltic concrete, (cold and hot-laid), sheet asphalt , natural asphalt, sawdust asphalt, vermiculite asphalt, rubber asphalt, cork asphalt, other patented asphalt mixes.
Synthetics	Rubber, synthetic resins, rubber asphalt, chlorinated butyl-rubber, mineral fiber, plastics, vinyls.
Concrete	Monolithic, terrazzo, precast.
Masonry	Flagstone (sandstone, limestone, granite, etc), brick, etc.
Miscellaneous	Tanbark, sawdust, shavings, cottonseed hulls.

Turf

The advantages of using grass as a surface are its attractiveness, resiliency, and nonabrasiveness, and the fact that it is relatively dust-free. Such a surface lends itself very well to activities that require relatively large areas, as most field games do.

Turf is difficult to maintain in areas where there is intensive usage. In some parts of the country where watering is essential, maintenance costs are high. Turf surfaces are not practical for most activities when the ground is frozen or wet, and, in addition, must be given time and care to recuperate after heavy use.

Soils

Among the difficulties encountered in the use of earth as a surfacing material are dust and the tendency to become rutted, which, in turn, create drainage problems and relatively high maintenance costs. These difficulties can be partially overcome by mixing the earth with sand. When this is done, the resulting surface is often less resilient and somewhat abrasive.

Natural soils can also be stabilized by the addition of asphalt, calcium chloride, resin, or cement, which are the most commonly used stabilizers. The use of stabilized soils is

a possibility in many areas where turf is impractical or cannot be grown.

Masonry

Natural-stone slabs, or blocks, and manufactured brick can be used for such installations as walks and terraces, where interesting and attractive patterns, colors, and textures are desired.

Concrete

Portland cement concrete surfaces provide year-round and multiple usage. Installation costs are high, but maintenance costs are low and the surface is extremely durable.

Asphalt

The common asphaltic concrete surface has many of the advantages which are sought in any surfacing material. It provides a durable surface which can be used on a year-round schedule. Maintenance is easy and inexpensive. Such a surface can also be used for many different activities. When properly installed, the surface is dust-free and drains quickly. Asphalt surfaces can be marked easily and with a relatively high degree of permanence. Asphalt also provides a neat-appearing, no-glare surface that will blend well with the landscape.

Asphalt can be combined with a variety of other materials to provide a resilient or extremely hard surface. The use of such materials as cork or rubber in combination with asphalt will yield a quite resilient surface. Aggregates such as slag or granite will produce a firmer surface when combine with asphalt.

Outdoor Synthetic Surfaces

The past decade has seen a proliferation of synthetic surfaces both for indoor and outdoor use. Various names (synthetic, all-weather, artificial) have been applied to these surfaces. Originally, the synthetic surfaces were developed to provide an all-purpose, all-weather surface for a variety of activities. More recently, however, although many of the surfaces may have a multi-purpose use, most are specifically designed for a particular type activity. The prospective facility planner should recognize that there are wide differences between the various types of surfaces as well as production differences between surfaces of the same "brand" name to be used for different purposes.

Considerations

Synthetic surfaces have several exceptional benefits. They provide a consistently smooth and uniform surface; greatly expand the use of the area, not only for multi-use, but for all students rather than exclusive use by athletic teams; provide the opportunity for use under all but the most adverse weather conditions; are generally regarded as safe as many of the natural surfaces (the controversy over this aspect of synthetic turf has not been fully resolved); increase the effective use of an alloted area; provide economic benefits through reduced acreage requirements; increased use and decreased maintenance costs. Finally, many of the top regional, state, national and international events in some sports are conducted on synthetic surfaces providing for greater uniformity in performance.

Outdoor synthetic surfaces do have major disadvantages, some types more so than others. In general, the following should receive attention and consideration:

- Initial costs are high, some types double or triple others, depending upon grading, sub-surface, installation process, and selected material.
- Maintenance, although minimal in some cases, is necessary. When required, it is both costly and time-consuming. Maintenance is reduced if measures are taken to reduce or eliminate vehicular and pedestrian traffic and security measures are taken to reduce the possibility of vandalism and misuse.
- Aspects of the weather do affect the outdoor synthetic surfaces. Extreme temperatures may alter the resiliency of the surface. The character of the composition may also alter over a short period of time either from temperature extremes or ultra-violet exposure. Asphaltic compounds may become brittle due to oxidation of the asphalt cement.
- Limited research studies have indicated a heat build-up on the surface which may affect the performer.

Types

There are three basic types of synthetic surfaces in widespread use today under a variety of trade names: synthetic turf, asphalt composition and plastic surfaces. Synthetic turf (grass) is used on those playing areas for games (baseball, football, soccer, field hockey, lacrosse, etc.) traditionally played on natural grass surfaces. The various asphaltic surfaces and the newer plastic surfaces (polyvinylchloride or polyurethane) have found their greatest use on tennis courts, tracks, and multi-purpose play areas.

Synthetic grass is a tufted carpet made from polyvinyl chloride or urethane plastic. It may be applied on a variety of subsurfaces, but asphaltic concrete is the more common. The composition of the subcarpet base varies in thickness and resiliency, depending upon anticipated use of the surface. Embedded in, or bonded to, the subcarpet base are plastic fibers resembling grass. The density and height of the blades vary with anticipated use. Installation of the combined fibers and subcarpet base is generally accomplished from rolls five yards wide of appropriate length. It may be bonded to the base or stretched and anchored in place.

Asphalt Composition - the numberous varieties of asphalt mixes, often in combination with cork, fiber, rubber, or plastic, are classified into two types—those with a cushioned surface and those with a non-cushioned surface. These surfaces require a base course (compacted stone, gravel, or rough aggregate asphalt), a leveling course (hot asphalt mix, emulsified mix, or cold asphalt mix), and a surface course (non-cushioned) or a cushion course (hot or cold mix). A color finish coat made from synthetics (epoxies, neoprene, acrylic vinyls or latex) is often applied to the non-cushioned surface to smooth it and give it color. The cushioned materials are color impregnated. Lines are applied by use of a synthetic paint, appropriate for that type of surface.

Plastic Surfaces

The two plastic surfaces used in outdoor setting include polyvinyl chloride (PVC) and an elastomeric polyurethane. PVC has not proven totally satisfactory at this time for outdoor use due to its reaction to the sun's rays and resiliency fluctuations caused by temperature changes. The plasticizer used in the PVC setting process also tends to exude through the top surface.

A two-part polyurethane, laid in prefabricated sheets or

monolithically applied on a suitable base, provides a durable, color-fast, and wear resistant surface with consistent resiliency. The surface may be smooth or embossed, depending upon projected use. Lines are painted with a synthetic paint as recommended by the manufacturer.

Evaluation Criteria

Criteria used to evaluate any of the outdoor synthetic surfaces include initial cost, maintenance and repair, durability, color, traction, impact absorption, resiliency and consistency of resiliency, effects of temperatures and sun, tensile strength, texture, color stability and utilization.

Lighting

The use of outdoor lighting should be considered for maximum use of facilities. The availability of facilities in the evening hours can greatly increase interest and participation.

The lighting of outdoor areas involves many problems not encountered in other types of lighting. A good lighting installation can only result from careful blending of the proper quantity of light, which is relatively easy to provide, with a good quality of light.

Sports lighting involves many problems. These problems can best be solved by consultation with lighting experts. Private consultant firms, local utility companies, and manufacturers of lighting equipment are available to offer assistance.

The most reliable source of general and specific information on the subject of sports facility lighting is the Illuminating Engineering Society's publication entitled *Current Recommended Practice for Sports Lighting.* This publication covers all aspects of sports lighting in considerable detail.

Figure 4 lists illumination levels for outdoor facilities which have been recommended by a panel of health, physical education, and recreation facilities experts. In all cases, these recommendations are equal to, or exceed, the illumination levels recommended by the Illuminating Engineering Society.

Figure 4
*Levels of Illumination Currently Recommended For Out Door Sports Areas**

Sports Area	Footcandles on Task
Archery	15
Badminton	30
Baseball	100-150
Basketball	70
Corkball	30
Field Handball	30
Field Hockey	30
Football	100-150
Golf Driving Range	30
Handball	60
Horseshoes	30
Ice Hockey	70
Lacrosse	50
Rifle and Pistol Range	100
Rugby	100
Skating	30
Soccer	100
Softball	100
Speedball	100
Tennis	70
Volleyball	70
Swimming Pool	30

**Because of the nature of outdoor lighting and the types of fixtures available at this time, it is difficult, if not impossible, to reach the lighting levels desired for most outdoor activities. However, it is expected that further improvement in outdoor fixtures will provide the desired higher-level intensities with a minimum of direct glare.*

General Area Lighting

Where specific sports facility lighting is not required, modified or general lighting can be provided. Generally mounted on poles or structures on the perimeter of the area, this type provides sufficient lighting for movement throughout the area and is usually arranged so as to cover as much area as possible with the greatest economy. Time clocks can be incorporated into the system to turn off the lights at a specified time.

For both sports facility and general area lighting, underground conduits are recommended.

Housing for Electrical Controls

A vital part of any outdoor lighting system is the protective and control equipment necessary to make it function. The very nature of this equipment represents a real hazard to anyone not familiar with its operation and the characteristics of electricity.

The development of new light sources has resulted in more frequent use of high voltage for larger outdoor lighting systems. Distribution systems of 240 and 480 volts are common, and, in some instances, a primary distribution system using 2,400 or 4,160 volts to strategically-placed distribution transformers can be justified.

Wherever such equipment is located, the controls must be adequately housed and padlocked. Where buildings or bleacher complexes are adjacent to the lighted area, consideration should be given to locating the controls inside a control room where they can be protected from unauthorized persons.

Parking

The need to provide off-street parking for automobiles is a major consideration in the design of facilities. Each parking space should be marked. It is often more desirable to construct parking areas in several locations, near the facilities which have the highest concentration of users. This will also make it easier to blend the parking areas into the landscape. Where possible, parking areas should be located near the perimeter and should be designed so as not to interfere with normal pedestrian traffic. In the case of large parking areas, it is necessary to make a study of the traffic pattern in the surrounding area in order to facilitate the movement of traffic to and from the parking area.

The off-street parking areas should be hard-surfaced, and may be used also for sports, free-play activities, driver education, marching band maneuvers, and other activities. Either post sleeves, flush with the surface, or portable standards will make it relatively easy to conduct a variety of net games in these areas.

Communications

A simple public address system would be adequate for all events other than a football game. A good press box is needed at the football stadium. Each newspaper should have its own working space, while television and radio personnel need separate booths. A duplicating and processing area, telephones, a distribution and storage area for food, and a deck for photography should be included in the press box plans. The main controls need to be located in or adjacent to the public address system. Microphone jacks should be installed at strategic locations at field level, and a direct telephone connection should exist between the field level and the press box.

Service Facilities

Facilities for the dispensing and storage of playing equipment should be on or readily accessible to the site. These facilities should include space for maintenance equipment, and for benches, tables and chairs, and rest rooms for men and women spectators.

Plans for such areas should include consideration of the accessibility of dressing and shower facilities for home and visiting teams, game officials, and coaches. In many situations, it has been found more economical to provide transportation to and from the playing site than to construct these facilities.

Sports and Athletic Facilities

Ball Fields

Steps should be taken in the initial planning of a community school program to make the playfield as accessible and functional as possible.

Three improvements are possible to encourage wider community use of the already popular playfield. Paving an outdoor court area would probably do more to encourage use of outdoor school facilities than any other single improvement since a large number of recreational activities are best carried out on a hard surface.

Lights represent a second improvement that will increase playfield use. Both adults and children can use the field in the evenings for organized or casual recreational activities.

A third valuable improvement is the provision of washroom facilities accessible from the playfield. This arrangement makes these facilities available when most of the school building may not be in use.

Baseball Field

The area required for a baseball field should be 400 feet by 400 feet, an area of approximately three acres. This will allow for dugouts and bleachers as well as the playing area.

Its orientation may vary a little, depending on where the field will be located and the time the games will be played—afternoon or twilight. However, if possible, the back point of home plate should be set to point due north to north-east. Another check is to have the baseline from home plate to first base run westerly.

The official diamond is 90 feet on a side, with the dimensions across the diamond 127 feet 3⅜ inches. There should be a minimum of 60 feet from home plate to the backstop. From home plate, down the foul lines to the outfield fence, the distance varies. However, 320 feet should be a minimum. The shortest part of the ball park is usually down the foul lines with the fence gradually going out to reach its deepest point in centerfield. (Figure 5)

A large frame backstop with a sturdy wire fence should be located 60 feet behind home plate. This backstop should be a minimum of 20 feet high to help keep the ball in the field of play. Attached to each end of the backstop should be a fence at least four feet high, 60 feet from the nearer foul line, and extending to the outfield fence where they join in foul territory at least 45 feet from the foul line. The outfield fence should be eight feet high for maximum safety. If a shorter fence is used, be certain that no points or other sharp obstructions extend up above the top rail. All fence posts should be on the outside of the playing area.

Dugouts, warning track, scoreboard, press box, auxiliary mounds, and other accessories should be taken into consideration. Dugouts are too often built too small, with not enough head room. It is recommended that the end of one dugout be used for storage. The traditional dugout, sunk into the ground to allow for spectator clearance, is obsolete because of drainage problems.

Junior Baseball

Junior baseball facilities are similar to regular baseball, except that the playing area may be reduced, depending on the age of the participants. Some national organizations that sponsor junior baseball programs have modified the official rules to fit the needs of the players. For example, the distance between bases is shortened as are the distance from home plate to the outfield fences and from home to the pitcher's plate. For recommended dimensions of Little League, Pony League, and Babe Ruth League, see Figures 6, 7, 8, 9.

Softball Field

Fast pitch and slow pitch softball have enjoyed great popularity. From summer recreation programs to professional leagues, thousands of individuals play softball each year. Fast pitch has been added to the women's varsity programs in many high schools and colleges. Each year the best university and college women's teams play in districts and regionals which culminate in a softball world's series.

Softball fields vary in types from "cow pasture" variety to well-kept diamonds. The best fields have skinned diamonds with all grass, weeds and rocks eliminated. Three features which are common to all "class" playing areas are: good construction, proper soil structure, and careful maintenance. All three must be present for a quality field. A well-kept diamond and outfield give each player a chance to perform at the best of her or his ability. A good facility can be used earlier in the spring and made playable sooner after a rain storm.

For elimination of complicated ground rules, it is recommended that the field be enclosed with a fence approximately 8 feet in height. The rule book states that the playing field shall have a clear and unobstructed area within a radius of 225 feet for males and female fast pitch, 250 feet for female slow pitch and 275 feet for male slow pitch from home plate between the foul lines. Outside the foul lines and between home plate and the backstop, there should be an unobstructed area of not less than 25 feet in width.

The official diamond should have 60 foot base lines with pitching distances as follows: Fast pitch, male - 46 feet, female - 40 feet; slow pitch, male - 46 feet, female - 46 feet. Layout of the diamond is shown in Figure 10. For best all

around orientation for late afternoon, twilight, fall schedule, and early afternoon games, position the apex of home plate 20 degrees north of northwest.

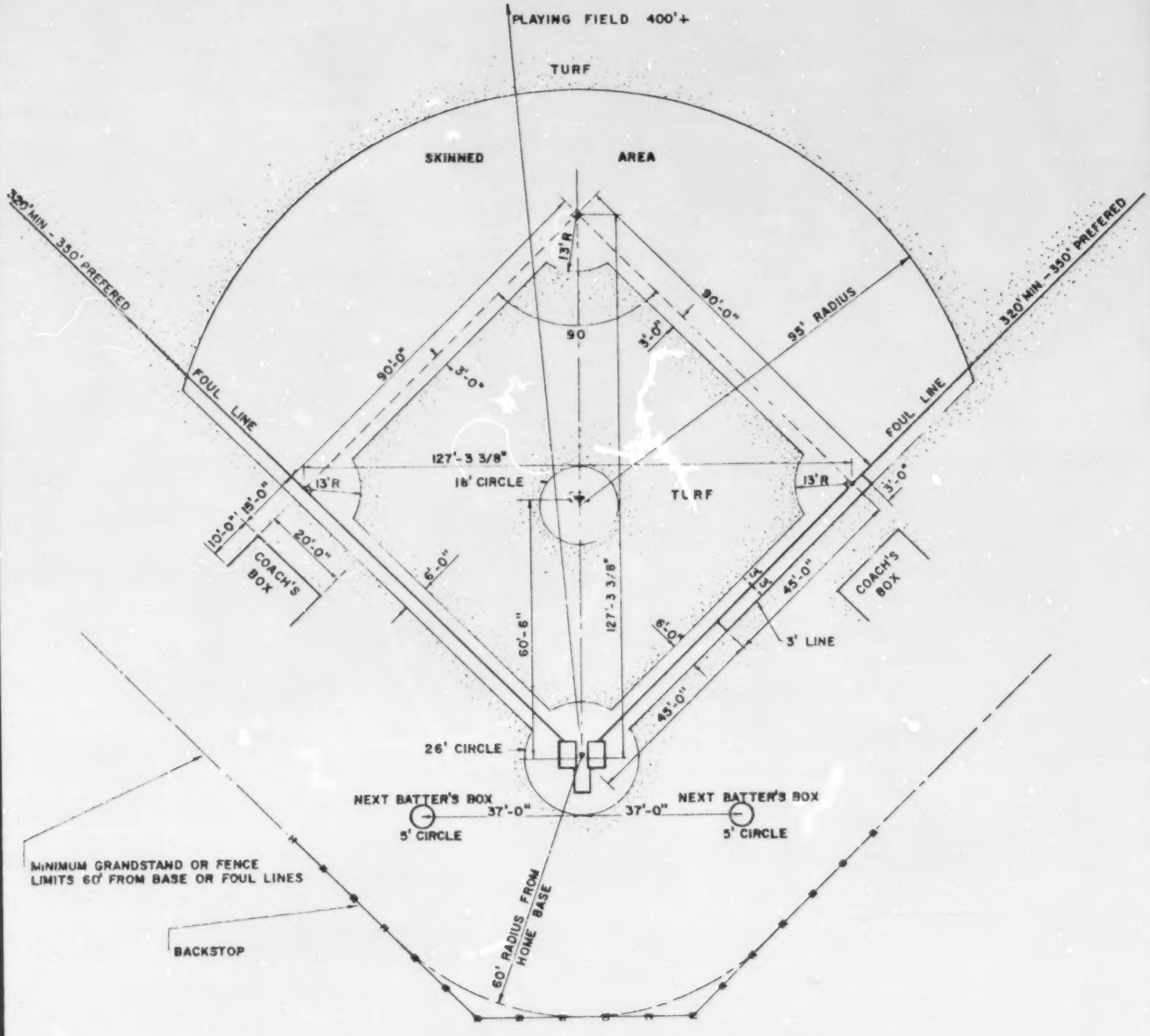
Irrigation

Since the outfield will be grass, some type of irrigation should be planned. Water outlets should be conveniently placed around the outfield and covered by rubber safety caps level with the ground. An automatic sprinkling system is more expensive to install, but may be cheaper in the long run when labor savings and convenience are considered. When planning the water lines, locate outlets for water fountains, concessions stands and possibly toilets.

Backstop

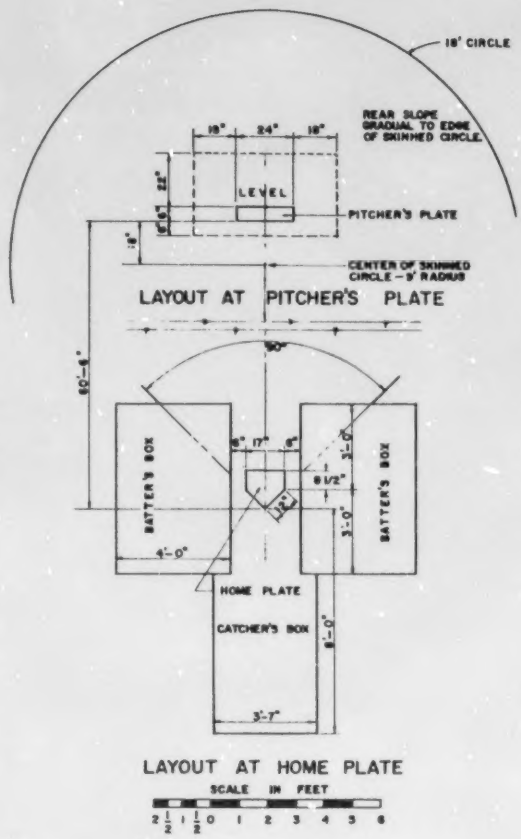
The field must also have a backstop erected not less than 25 feet behind home plate. The backstop should consist of three panels 12 feet wide, one panel centered on home plate,

Figure 5



BASEBALL DIAMOND LAYOUT

Figure 6



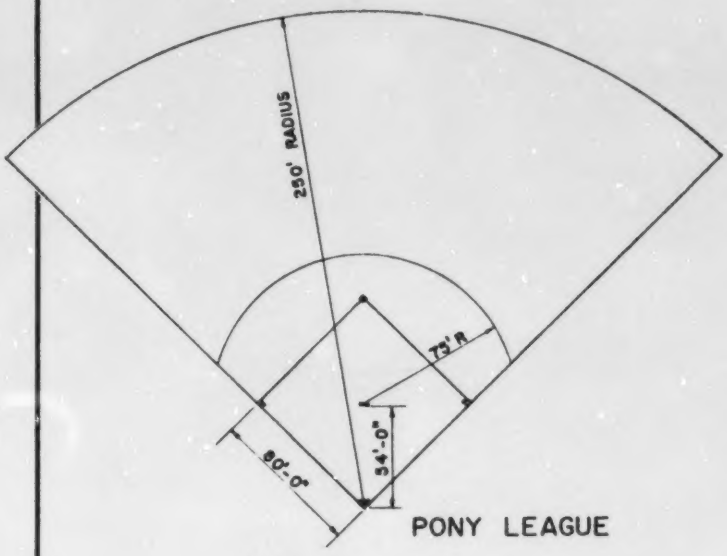
The degree of slope from a point 6" in front of the pitcher's plate to a point 6' toward home plate shall be 1" to 1', and such degree of slope shall be uniform.

Figure 7
Boy's Baseball Field Diagrams

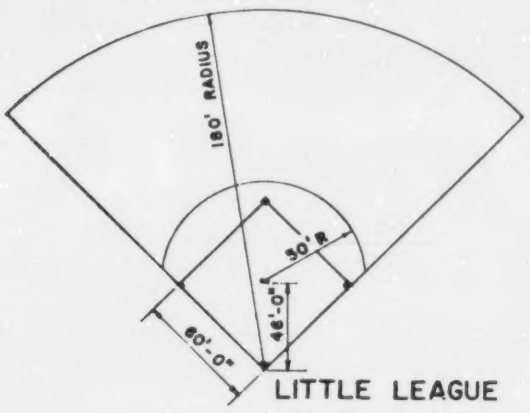
with the other two panels on each end flaring out at an angle of 30 degrees with the center panel. Each panel should be 18-20 feet in height. The uprights and cross pieces of each panel can be made from steel or wood. One and one half inch galvanized wire mesh is stretched and fastened between the uprights on each panel.

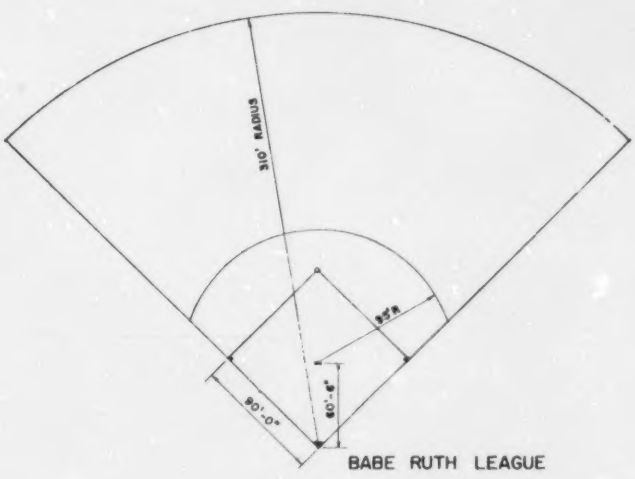
Bleachers and Player Benches

Softball fields must have adequate seating for spectators if interest in the sport is to be maintained. The bleacher area should be separated from the playing field by a fence or rope. If possible, position bleachers so that spectators are not looking into the sun. Players benches with back rests should be provided for each team and positioned at least 25 feet from each foul line.



Figures 8 & 9





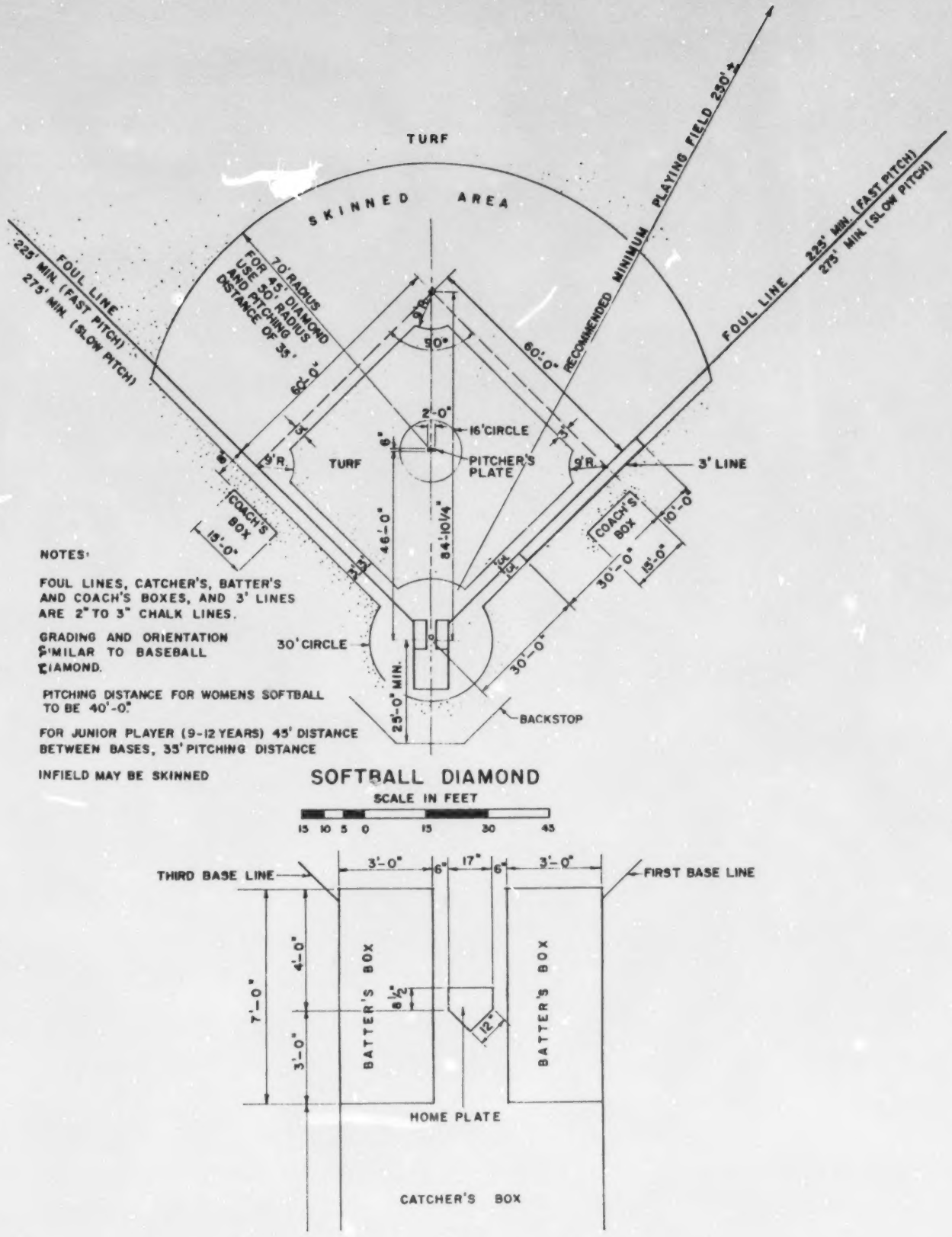

TURF
SKINNED AREA
70' RADIUS FOR 45' DIAMOND USE 50' RADIUS AND PITCHING DISTANCE OF 35'
FOUL LINE 225' MIN. (FAST PITCH) 275' MIN. (SLOW PITCH)
60'-0" RECOMMENDED MINIMUM PLAYING FIELD 230' ±
FOUL LINE 225' MIN. (FAST PITCH) 275' MIN. (SLOW PITCH)
9'R.
50°
60'-0"
2'-0"
16' CIRCLE
3'
6"
5'
TURF
5'R.
PITCHER'S PLATE
5'R.
3' LINE
COACH'S BOX
15'-0"
46'-0"
84'-10 1/4"
10'-0"
30'-0"
15'-0"
NOTES:
FOUL LINES, CATCHER'S, BATTER'S AND COACH'S BOXES, AND 3' LINES ARE 2" TO 3" CHALK LINES.
GRADING AND ORIENTATION SIMILAR TO BASEBALL DIAMOND.
PITCHING DISTANCE FOR WOMENS SOFTBALL TO BE 40'-0"
FOR JUNIOR PLAYER (9-12 YEARS) 45' DISTANCE BETWEEN BASES, 35' PITCHING DISTANCE
INFIELD MAY BE SKINNED
30' CIRCLE
25'-0" MIN.
BACKSTOP
SOFTBALL DIAMOND
SCALE IN FEET
15 10 5 0 15 30 45
THIRD BASE LINE
3'-0"
6"
17"
6"
3'-0"
FIRST BASE LINE
4'-0"
7'-0"
3'-0"
BATTER'S BOX
8 1/2"
12"
BATTER'S BOX
HOME PLATE
CATCHER'S BOX

Figure 10

Scoreboard

A scoreboard adds interest for both spectators and players. It need not be elaborate but should show results by innings.

Field Hockey

The dimensions of the field are 300 feet long and from 150 to 180 feet wide. A smaller field of 255 feet by 135 feet can be used for younger players.

The field should be marked with two-inch white lines. There should be four lines across the width of the field that divide the length of the field into four equal parts 25 yards apart. The lines at each end are called goal lines. The line that bisects the field is called the center line. The other two lines between the goal and center line are the 25-yard lines. When the field is smaller, the 25-yard lines should be 25 yards from the goal lines. Parallel to, and five yards from each side line, is a broken 5-yard line. The space between the 5-yard and side lines is called the alley. At each end of the field is a striking circle. The striking circle should be marked regulation size, which is 45 feet from each goal post out to the side. The "circle" part should have a 45 foot radius from each goal post. The penalty corners are marked 30 feet to the side of each goal post on the goal line. These penalty lines run 12 inches from the goal line into the field. At the center of each goal line is a goal 12 feet wide. (Figure 11)

The playing surface should be a multipurpose turf or loam. This turf should be crowned down the center, sloping one-fourth inch per foot toward the sidelines for better drainage. The field should be oriented so that play is in a north and south direction.

The goals also have certain specifications. The goal posts should be two-by-three inches and painted white. The goal posts are seven feet high, twelve feet apart, and joined by a crossbar seven feet above the ground. Six feet behind the goal line are two six-foot posts. The sides, back, and top are enclosed by netting or wire mesh.

Flicker Ball

The outdoor flicker ball field shall be rectangular in shape, its length being 53⅓ yards, its width 30 yards. (Figure 12). Each goal shall be set 5 yards back of the end line, equidistant between the side lines, and parallel to the end line. The bottom of the hole in the flicker ball board shall be eight feet above the ground. (Figure 13). A free throw line, 6 feet long, will be placed 30 feet in front of each end line, directly in

Figure 12
Flicker Ball Field

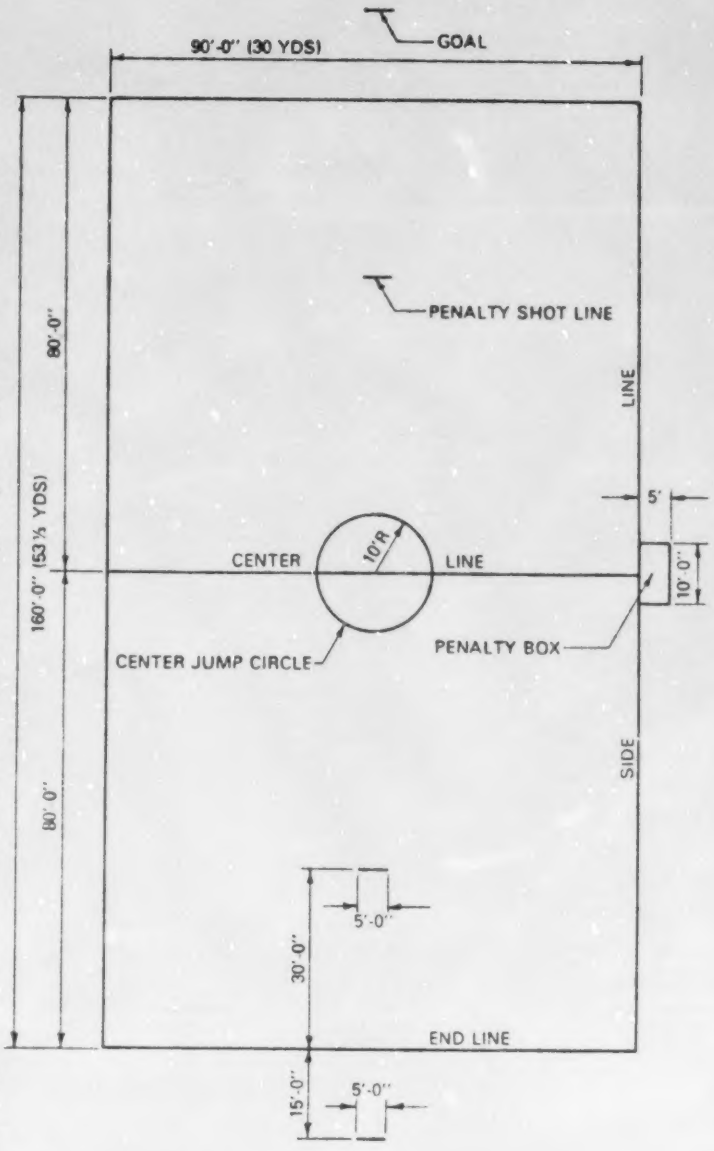
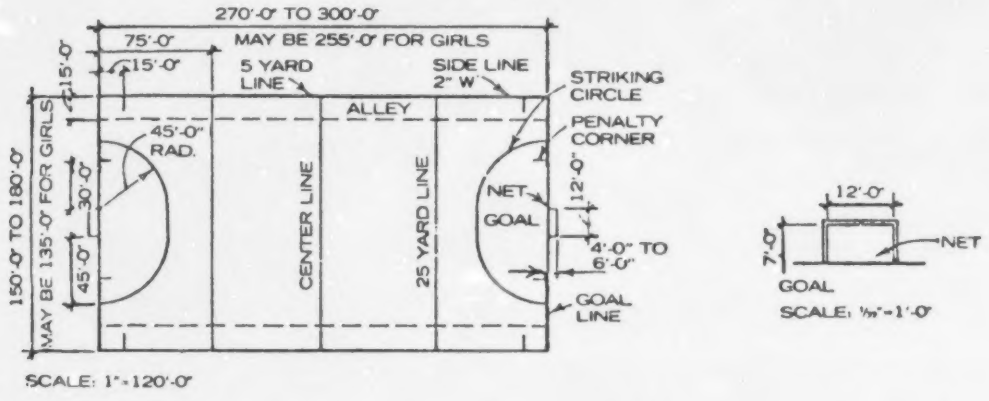
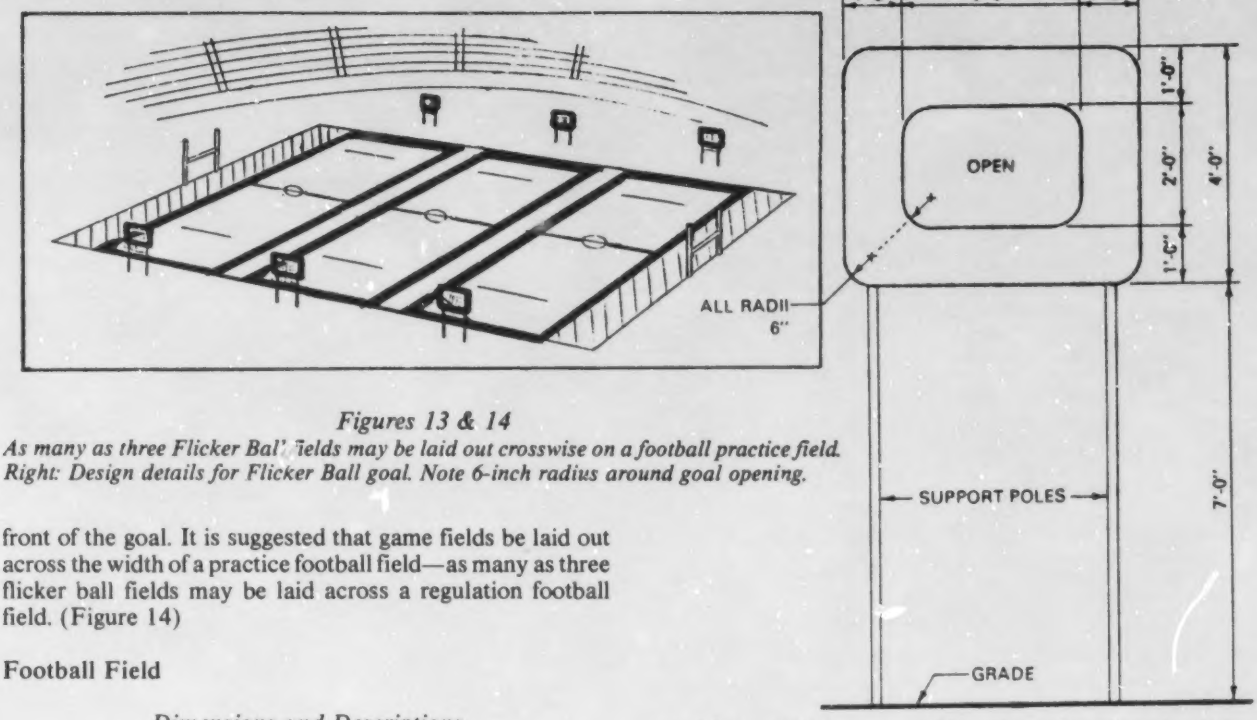


Figure 11 - Field Hockey Layout





Figures 13 & 14

As many as three Flicker Ball fields may be laid out crosswise on a football practice field. Right: Design details for Flicker Ball goal. Note 6-inch radius around goal opening.

front of the goal. It is suggested that game fields be laid out across the width of a practice football field—as many as three flicker ball fields may be laid across a regulation football field. (Figure 14)

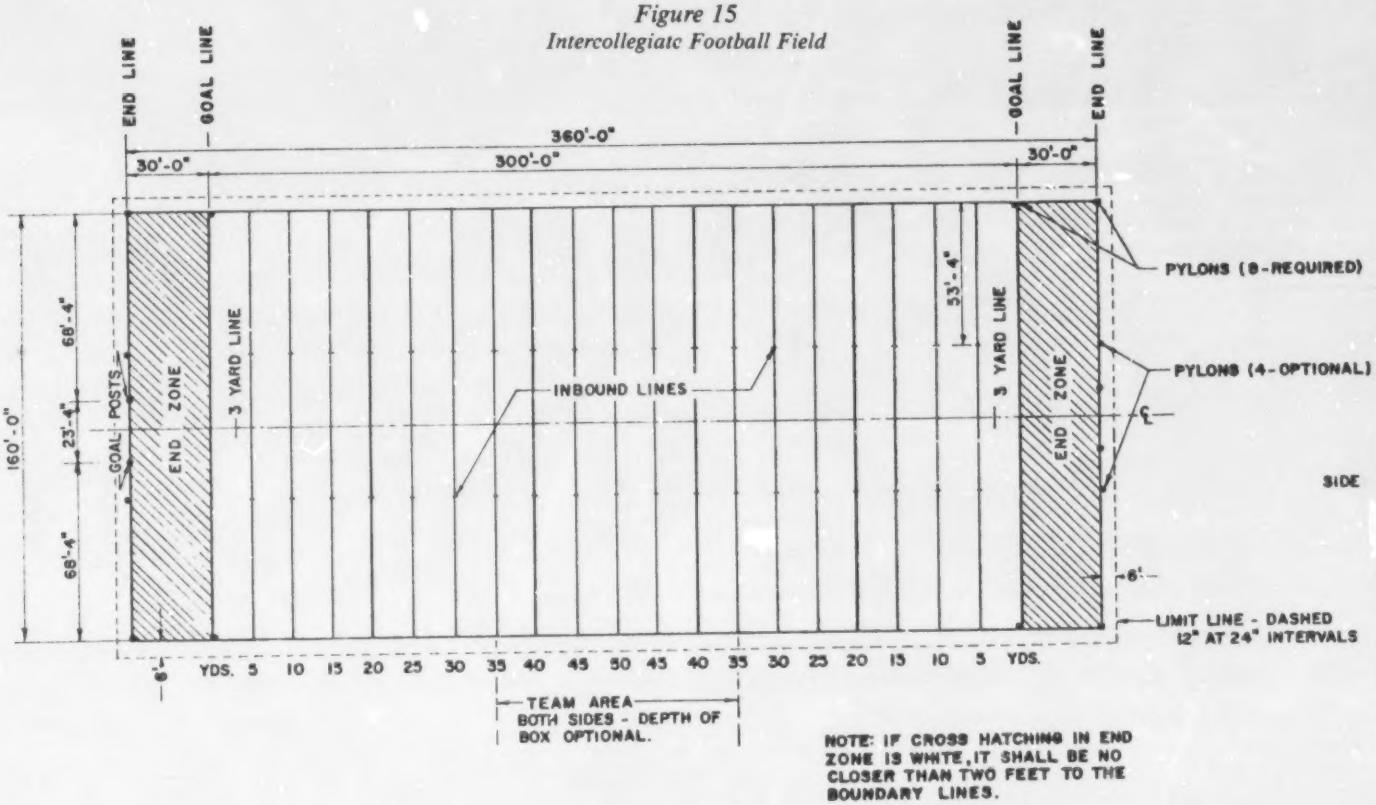
Football Field

Dimensions and Descriptions

The football field is a level area, 360 feet long and 160 feet wide. If games are played during daylight hours or the field is used for practices, it should be oriented so that play is in a north and south direction to insure that the sun does not shine directly into the eyes of the contestants.

Figure 15

Intercollegiate Football Field



White lines, called yard lines, run across the width of the field every five yards, and lines called sidelines, run down the length of each side. The goal lines run at each end of the width of the field at 100 yards apart, with the end zones extending 10 yards beyond each goal line. The yard lines are numbered at 10-yard intervals from the goal lines to midfield. Two broken lines, called inbounds lines, or hash marks, run parallel to the sidelines. For college, hash marks are 53'4" from each sideline, and for professional games, they are 70'9" from each sideline. (Figure 15)

In high school and college football, two goal posts, each 20 feet high, stand 10 yards behind each goal line. A crossbar connects them 10 feet from above the ground. The posts are 18'6" apart in high school games, and 23'4" apart in college.

Facilities should be provided for the press, radio and motion picture groups along with the public address system, scoreboard operators, spotters, scouts and other officials or dignitaries. The press box should be located opposite the 50-yard line, high in the west stand to eliminate direct sun glare.

The scoreboard should be designed as an integral part of the structure. For activities attracting a smaller number of spectators, mechanical or movable scoreboards may be more practical.

Turf or Surface

The surface of the field is usually regular turf and grass with a crown running down the center, sloping one-fourth inch per foot toward the sidelines. Turf is difficult to maintain in areas where there is intensive usage. When watering is essential, maintenance may be extremely high. Turf surfaces are not practical for most activities when the ground is frozen or wet and must be given time and care to recuperate after heavy use. It is now possible to have a complete turf installed with built-in moisture and temperature control.

Participant Safety

Spectators using the facility must be protected against injury. There should be guard rails on ramps and inclines and rough surfaces on inclines. Surface material of seats must be non-abrasive and in good condition. Lighting must be provided in the seating area as well as to the exits and restroom facilities. Ample walkways leading to exits, depending on capacity of crowd, must also be provided.

Thought must also be given to avoid injury to the participants. Sprinkler heads must be recessed with protective caps installed. Fences or other obstructions must be away from the playing field and goal posts should be padded along with down and distance markers. End markers should be flexible and padded. Lastly, ample light must be provided to allow for good visibility on the entire field.

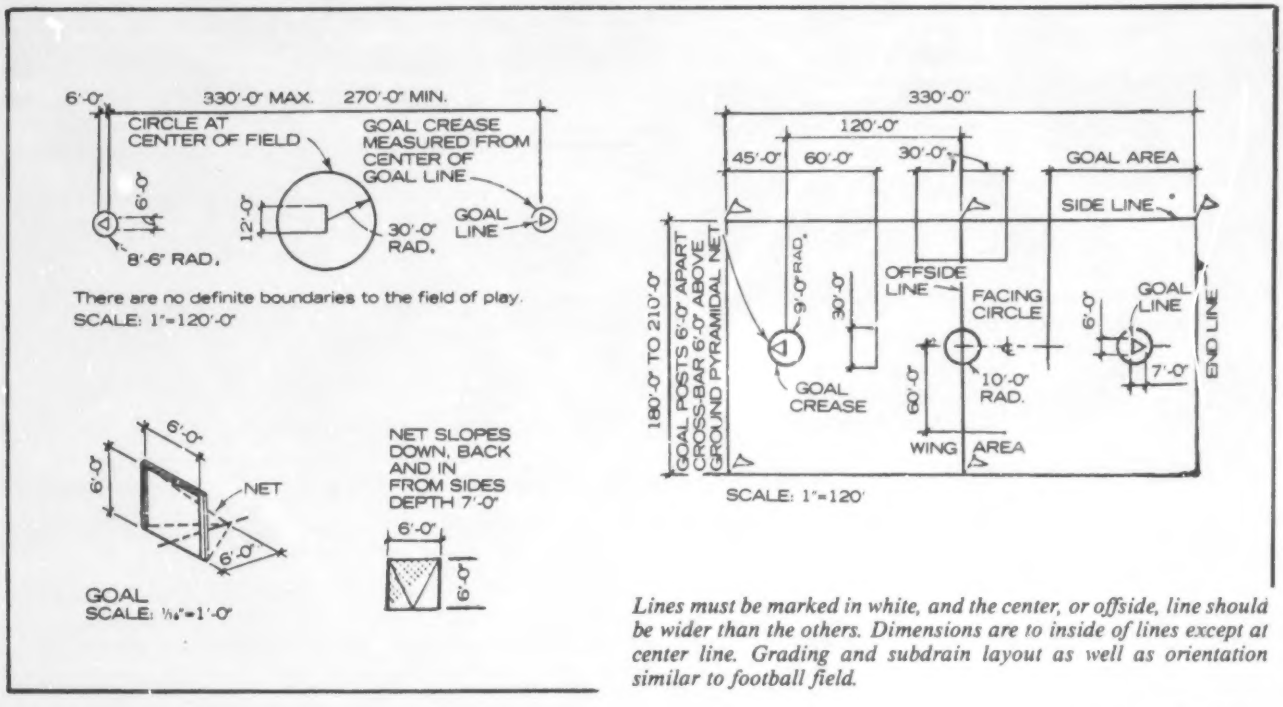
Lacrosse

The inside dimensions of the field for men are 330 by 180 feet. There are no definite boundaries, but goals must be placed not less than 270 nor more than 330 feet apart. The minimum width is 159 feet. (Figure 16)

The goals lie on the 15-yard lines at each end of the field. these goals consist of two square posts six feet apart and joined at the top by a rigid crossbar six feet above the ground (all inside dimensions). The wooden posts are two by two inches, painted white. Netting of not more than 1.5-inch mesh must be attached to the posts and crossbar and to a point seven feet behind the center of the goal. The net is firmly pegged to the ground. A line, called the goal line, is drawn from post to post.

Orientation, surface, and grading are the same as for football. A five or six foot barrier fence at least 10 feet outside the end and sidelines is recommended.

Figure 16
Lacrosse Field



Lines must be marked in white, and the center, or offside, line should be wider than the others. Dimensions are to inside of lines except at center line. Grading and subdrain layout as well as orientation similar to football field.

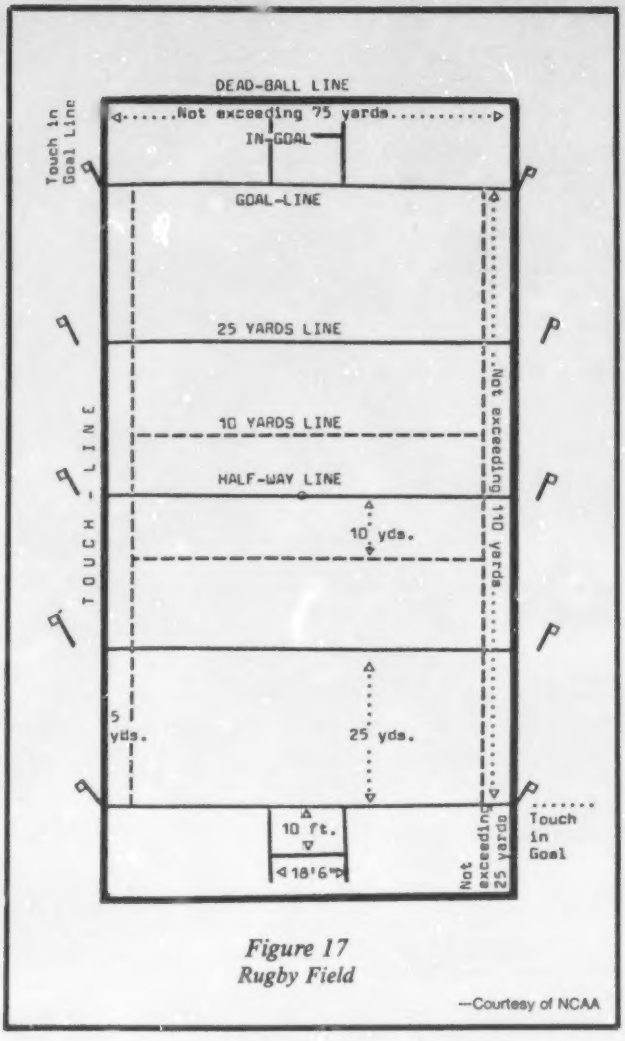


Figure 17
Rugby Field

—Courtesy of NCAA

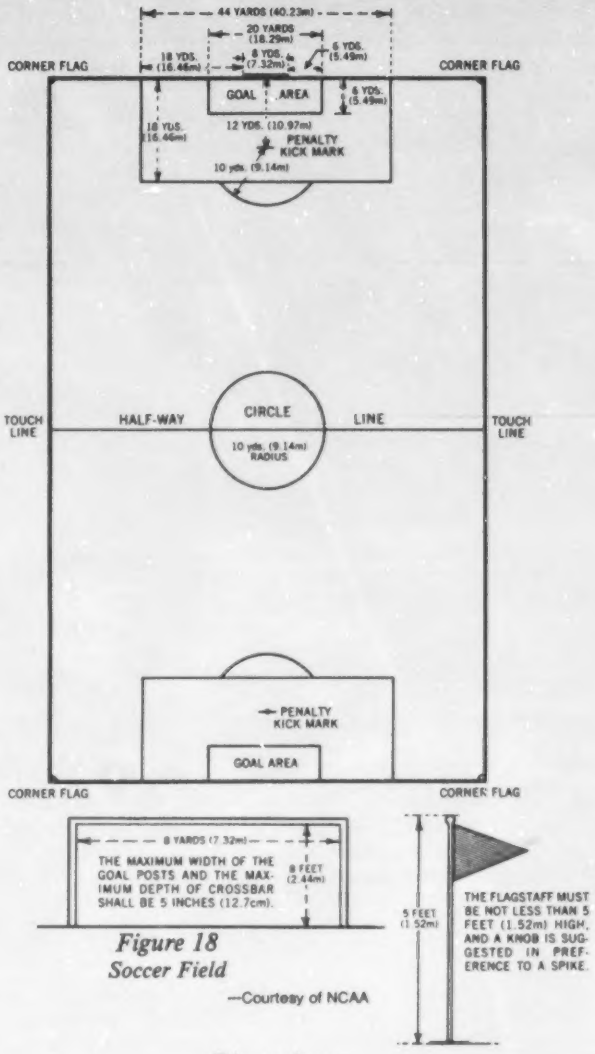


Figure 18
Soccer Field

—Courtesy of NCAA

Rugby

A rugby field differs in some respects from a football field; however, the game can be played without the addition or deletion of any football field markings. It is more desirable to have a properly marked rugby field. (Figure 17)

Soccer

Soccer fields should be laid out on the most level area of land available. In many high schools and colleges, the football field is also used for soccer games. When this is done, portable goals are used and if possible, the width of the field is increased 10-15 yards. Preferably, the field should be grass and free of rocks, holes, and other debris, with no obstacles on the playing area. The orientation of the field should be in a north-south direction.

The same consideration should be given to the soccer field as to all outdoor fields. The field should have subsoil tiling for proper drainage and a top soil composition which enhances a good growth of grass. Rubber-capped water outlets, and at ground level, should be spaced at convenient locations throughout the playing area. By using these water outlets and a few lengths of hose, the grass can be kept in good condition during the dry months. Be sure to allow for a drinking fountain when positioning your pipes for field irrigation.

Dimensions

The rules state that the field of play must be rectangular and not more than 120 yards in length or less than 100 yards. The width not more than 75 yards wide or less than 65 yards. The recommended size for high school and college fields is 120 yards by 75 yards. Fields for elementary school age players should be smaller in size.

The longer boundary lines are called touch lines, and the shorter, the goal lines. (Figure 18)

Goals

The goals will be placed on the center of each goal line with two wooden or metal posts, equidistance from the corner flag and eight yards apart. A horizontal crossbar of the same material will join the uprights with the lower edge eight feet from the ground. The width of the uprights and crossbar will not exceed five inches or less than four inches. The goal will be painted white and goal nets should be attached to the back of the goal posts.

Penalty and Goal Areas

Each end of the playing area has a penalty area of 18 yards by 44 yards and a penalty kick line 12 feet from the goal line and centered between the uprights of the goal. Using the

center of this penalty kick line, mark a 10 yard area arc outside the penalty area and closing on the penalty area line. This is the restraining line for penalty kicks. Also at each end of the field of play, two lines shall be drawn at right angles to the goal line, six yards from each goal post. These lines shall be joined by a line drawn parallel with the goal line. The space enclosed by these lines on each end of the field is called the goal area.

Corner Flags

In each corner of the field, a quarter circle having a radius of one yard shall be marked inside the field of play. Where the touch line and goal lines intersect, a metal sleeve should be installed in the ground to hold the corner flags.

Halfway Line

A half line will be marked out across the field of play. The center of the field will be indicated by a suitable mark and a circle with a 10-yard radius will be marked around it.

Bleachers and Player's Benches

If portable bleachers are selected, they can be moved each season and used by different sports. Spectator seating should be no closer than 15 feet from the touch lines. Players' benches, and a timer's table should be provided and placed on the same side of the field. These also should be at least 15 feet from the touch line.

Speedball

Speedball is a vigorous team sport played on an area 180 by 300 feet. The game combines the skills of soccer and basketball. It requires goal posts, end zones, and a soccer ball. There are 7 to 9 players to a team.

The size of the field should be reduced for young players and or intramural activities. A multipurpose field or soccer field can be adapted to the game. (Figure 19)

Team Handball

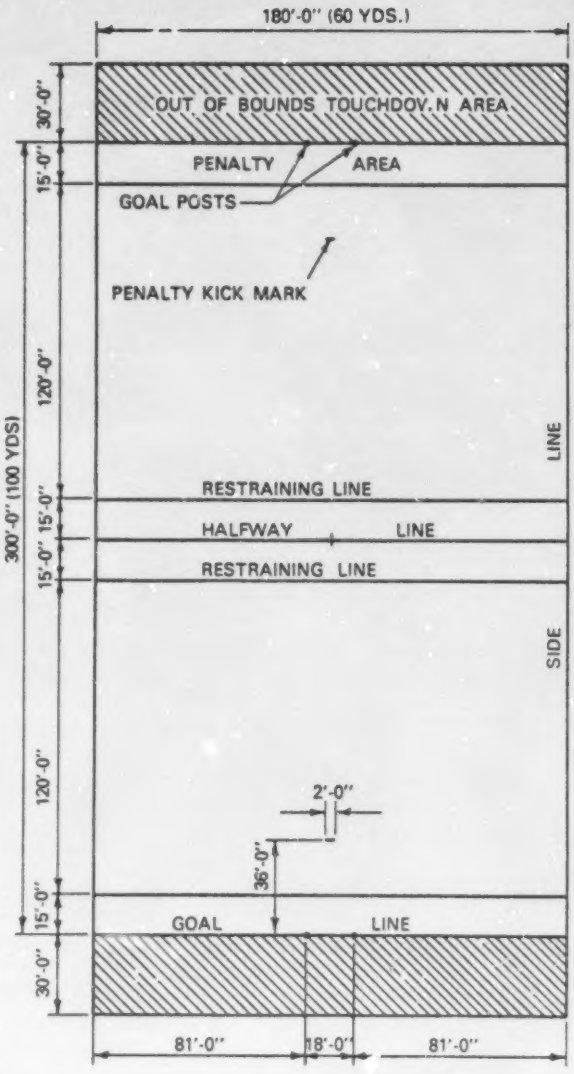
Team handball is played in both indoor and outdoor facilities. Official games, however, such as the Olympic games and European or international championships, are played only in indoor facilities. The recommended floor is hardwood (similar to basketball). The ceiling height is a minimum of 18 feet of 5.5 meters (m).

The court is a rectangle. The length ranges from a minimum of 124' 8⅛" (38m), to a maximum 144' 4½" (44m). The width ranges from a minimum of 59' ⅜" (18m), to a maximum of 72' 1¼" (22m). Courts are often made 20m by 40m; however, if meters are being used, 21m by 42m is most convenient for getting all measurements correct.

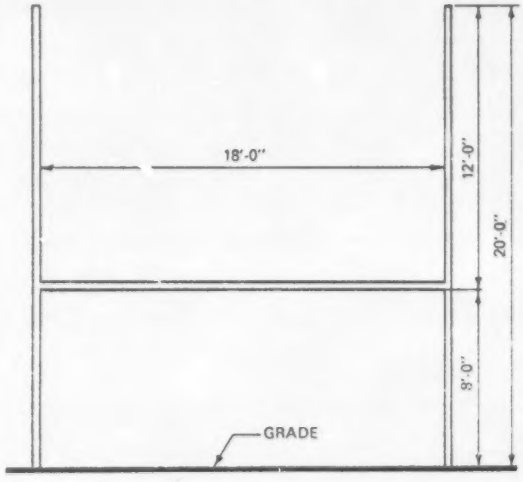
The goal is in the center and behind the goal line and is fixed and stable. It is 6' 6¾" (2m) high, and 9' 10⅛" (3m) wide. Behind the goal there is a net made of cotton or nylon. The goal posts and crossbar are made of squared wood 3.14" (8cm) thick. The goal is painted with two contrasting colors. The corners are painted with two rectangles of 11.2" (28cm) each. Each contrasting colored block on the goal post and crossbar is 7⅞" (20cm) long. There are ten of these on each goal post and 15 on the crossbar as indicated on the illustration.

The goal area is created by marking a line 9'10⅛" (3m) long, 19' 8¼" (6m) from the goal. To each end of this line, a quarter circle is added, with a radius of 19' 8¼" (6m) which

Figure 19
Speedball Playing Field Layout



Goal Posts



has as its center the front legs of the goal (the inner back edge).

The free throw line (9m line) is a dotted line 9' 10⅛" (3m) from the goal area line and parallel to it. The line is made of paint or 2" (5m) plastic tape, i.e.

15cm 15cm (5¾").
15cm 15cm 15cm

The penalty mark is 23' (7m) from the center of the goal and is 3'3½" (1m) long and 2" (5cm) wide. The center line connects the mid point at both sidelines.

All lines on the court are included within the area which they limit; they must be 2" (5cm) thick.

For sample field layouts and goal details, see Figures 20 and 21.

Metric conversion factor: 1cm = .394"; 1 m = 3.281' (3' 3⅜").

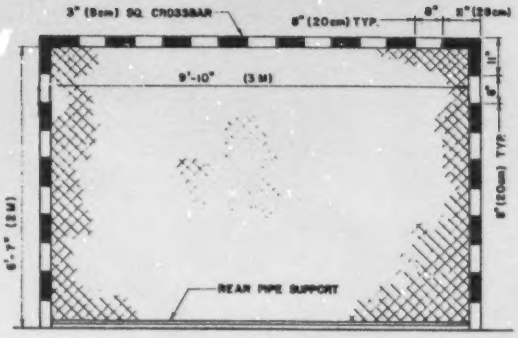
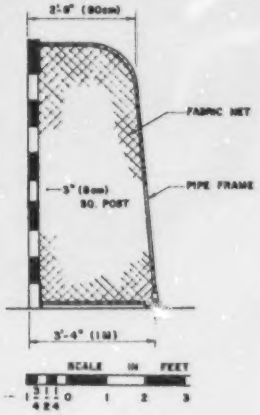


Figure 21
Team Handball
Goal Details



Goal line between goal posts. Posts and crossbar are metal or wood, painted all sides in two contrasting colors. Goals will be firmly fixed in ground with hooked stakes. Field lines are 2" (5 cm) wide and form part of the area they enclose.

Outdoor Basketball

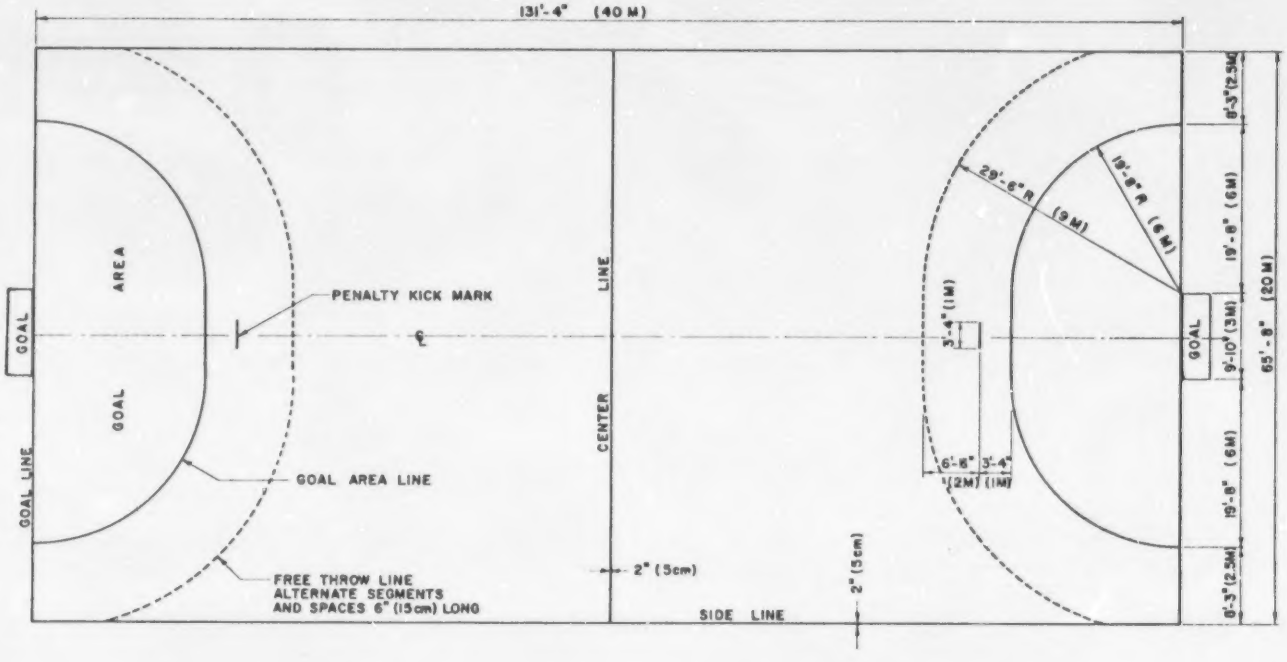
Court Construction

The game can be played either outdoors or indoors, but interscholastic and intercollegiate games are generally played indoors. Outdoor league play, however, is becoming increasingly popular. The following considerations can make an outdoor basketball facility more functional.

Site

It is important to have a flat area protected from the wind. The courts should have a dark background. It would be beneficial if restrooms and water fountains were available for the participants. Keep the basketball and tennis areas separated.

Figure 20
Team Handball Field



Orientation

Basketball courts should be oriented so the baskets face one another at approximately a north-south direction.

Surface

A smooth, hard surface is essential for playing the game of basketball, particularly the dribbling aspect.

The recommended surface is asphaltic concrete. It provides a durable surface which can be used on a year-round schedule. When properly installed, the surface is dust-free and drains quickly. Asphalt surfaces can be marked easily and with a relatively high degree of permanence. The asphalt surface also gives a neat-appearing surface that will blend well with the surroundings. The surface can also be colored and maintained inexpensively.

Portland cement concrete and synthetic surfaces have also been used, but they are much more expensive to install. The concrete surface may crack when constructed in a cold climate, due to frost heave.

Drainage

Drainage can be done many different ways, but it is recommended that the court be slanted from one side line to the other. One inch of slant should be allowed for every ten feet of court. It would also be helpful if the court is elevated from the surrounding area for drainage purposes.

Court Markings

Lines should be permanently painted on the surface in a color contrasting. These lines should be two inches in width. There should be line markings for the boundaries for the court, the mid-court line, the center circle, the foul lane area, and the three second line.

Dimensions

The dimensions for a basketball court are usually determined by the age group which is to use the facility. Recommendations for each age group are as follows:

Age Group	Court Size	Basket Height	Foul Lane Width	Foul Line To Basket
Elementary	10' x 40'	8'	5'	10'
Jr./Sr. High	84' x 50'	10'	12'	10'
College	94' x 50'	10'	12'	10'

When constructing a court for a recreational area, it is recommended that the 84' x 50' court be built. If the court is less than 74 feet in length, it should be divided by two lines, each parallel to and 40 feet from the further end lines. These lines would be used as the ten second lines. For court diagram see Figure 7, Chapter 2.

Safety Areas

When devising an outdoor basketball court, the following safety areas should be accounted for.

- Allow ten feet on all sides of the court, including the area between two courts.
- Poles used to hold the baskets should be off the playing court, and extended out at least four feet onto the court and padded.
- If possible, there should be some absorbent material around the basketball pole and the bottom of the backboard.

Backboards and Baskets

There are two popular types of basketball backboards, rectangular and fan-shaped. The size of the rectangular backboard should be six feet by four feet and the size of the fan-shaped backboard is fifty-four inches wide and thirty-five inches high.

It is recommended that an official iron basketball rim with an eighteen inch diameter be used. Chain nets may be used outdoors because they are more durable than the nylon or rope nets.

Fencing

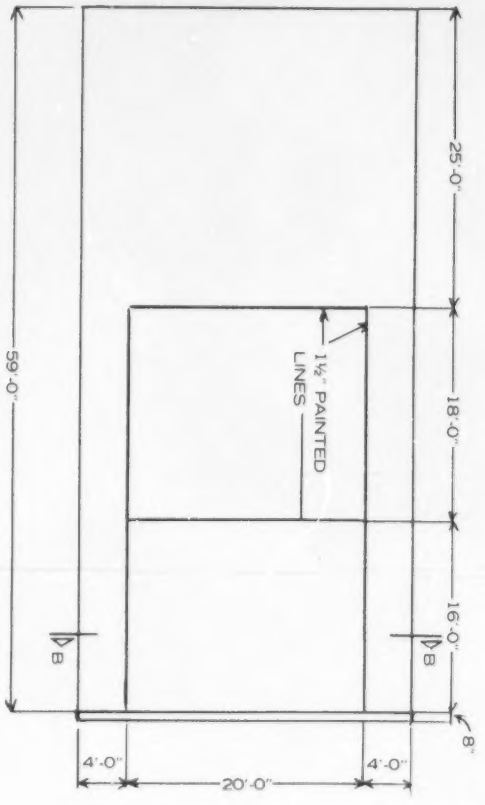
Although fencing is not absolutely necessary, it can be a helpful addition. If finances allow the purchase of a fence, the recommended type of fencing is an anodized aluminum chain-link fabric. The desired height would be ten feet. The fence fabric should be located on the inside of the fence poles and the poles placed six inches to a foot onto the hard surface. Posts should be in concrete 25% to 40% of the length of the pole above the surface. Doors should be provided which are large enough to allow maintenance equipment into the court area.

Handball

Indoor handball (4-wall) is discussed in Chapter 2 and illustrated in Figure 22.

Outdoor handball is either one-wall or three-wall. Both can be played by two to four players on a smooth portland cement concrete or asphaltic surface. Courts may be constructed so as to allow one court on each side of the wall. It is often

Figure 22
One - Wall Handball Court



desirable to locate the courts near soccer fields or tennis courts to permit soccer and tennis players to use the walls for practice.

Dimensions for the one-wall handball court are: 16' high, 20' wide by 34' long with 8'6" width on each side and 11' surfaced area to the rear. (Figure 22)

Dimensions for three-wall handball are: 20' high, 21'8" wide by 40' long with 10' to the rear. (Figure 23)

The courts should be pitched away from the wall with a grade of 1" to 10'. The wall should be 8 to 12 inches thick and constructed in reinforced concrete.

Shuffleboard

The shuffleboard court shall measure 52 feet long and 10 feet wide. The actual playing area shall be 39 feet long and 6 feet wide, or that area of the court from base line to base line and from inside rise to both adjacent gutters. (Figure 24)

Shuffleboard courts should be oriented north and south. A level, smooth surface is essential.

The courts are marked off by painting lines with a black dye, white road paint, or white acrylic stain. Lines will have a maximum width of one inch with a minimum width of ¾ inch. The base lines shall be extended to adjoining courts, or to 24 inches beyond sides of the court. The separation triangle in the 10-off area is 3 inches at the base, running to a point in the direction of the scoring area. The outline of the legs of this triangle shall be ¼ inch in width, with a clearance of ½ inch at both the point and base. The base of the separation triangle is not marked.

It is highly important that the area beneath the court be well-drained and the court properly reinforced. A depressed alley must be constructed between and at the sides of all

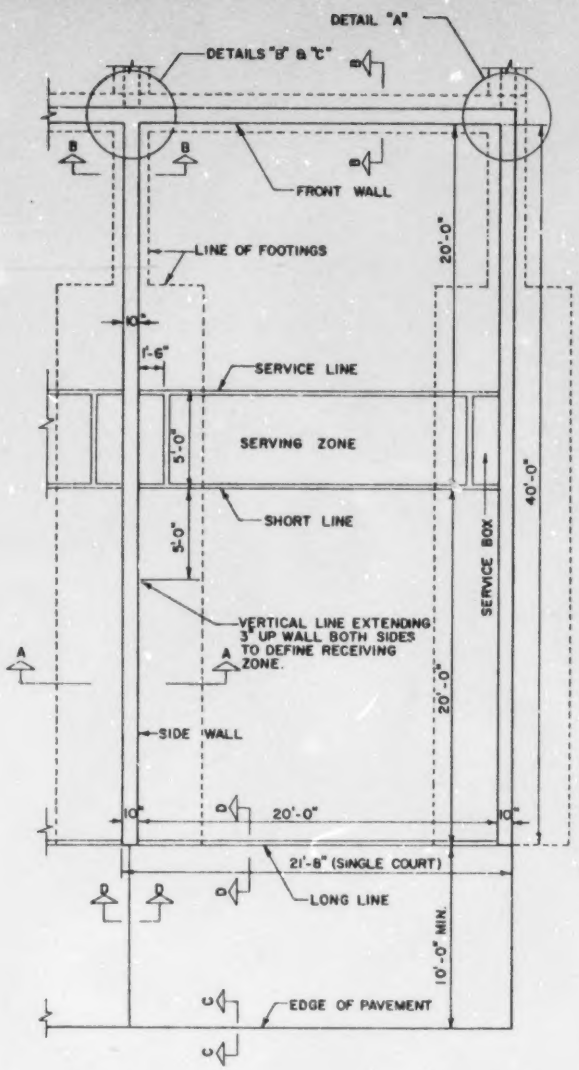
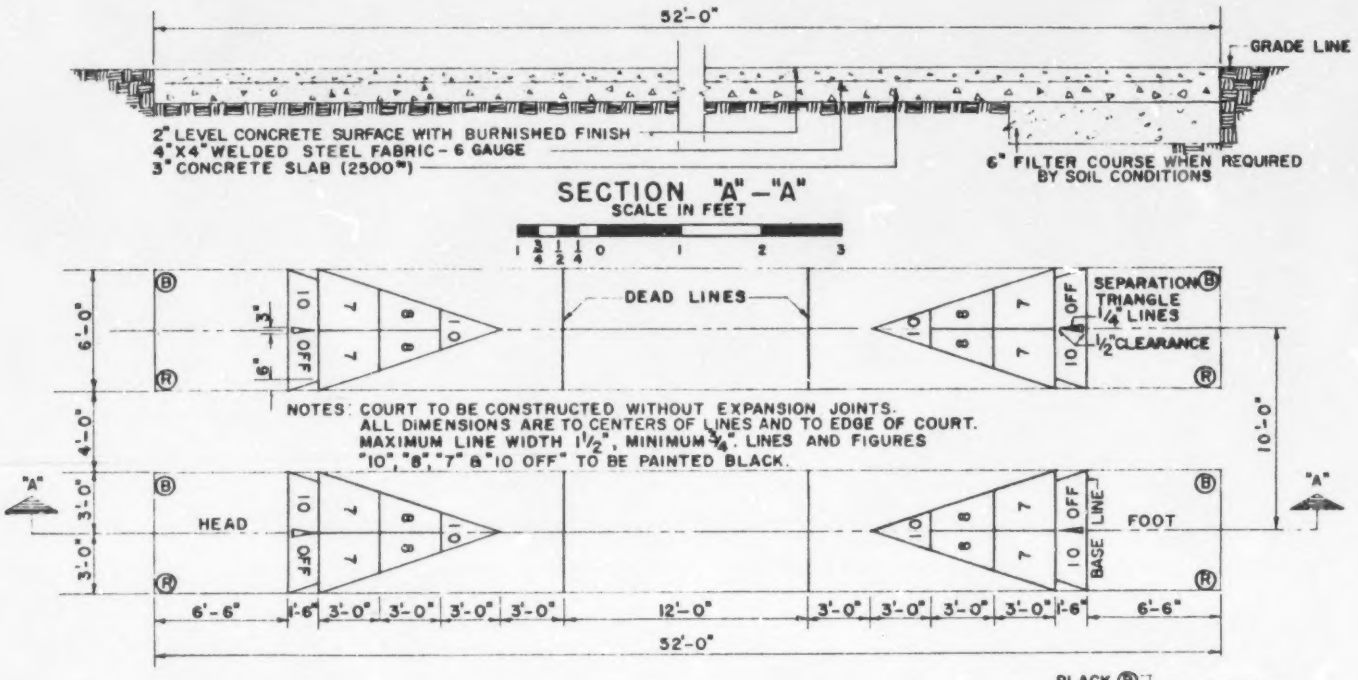


Figure 23 (Right)
Three-wall handball court

Figure 24 (Below)
Shuffleboard court



FACTORS TO CONSIDER IN SELECTING A TENNIS COURT SURFACE

1. Player preference.
2. Maintenance Cost and Amount of Maintenance required.
3. Initial Construction Cost.
4. Surface on which Player can Slide or Not Slide.
5. Length of time until resurfacing is required.
6. Resurfacing Cost.
7. Softness of surface desired for Player Comfort.
8. Surface adaptability for possible Other Uses.
9. Fast or Slow surface (see glossary).
10. Uniformity of Ball Bounce.
11. Effect of Color on Glare and Heat Absorption.
12. Drying Time after rain.
13. Availability of Service from Court Builder.
14. Color-Fastness of Surface and its effect on Ball Discoloration.
15. Effect of Abrasive surfaces on balls, rackets, shoes and falling players.
16. Effect of Lines on Ball Bounce, Tripping Hazards, Maintenance of Lines.

courts. The alley should be at least 24 inches wide and not less than 4 inches deep at mid-court, where a suitable drain shall be installed. The alley, from both extensions of the base lines, should slope down toward the center of the court. The downward fall shall begin with a one inch drop in the first six inches, and then gradually slope down to mid-court.

Shuffleboard courts are commonly lighted from poles erected outside the courts. A 20 inch hinged pole with a 1500 watt quartzlit floodlight would be installed at the base of the court next to the scoreboard or benches at the base of the court. Overhead lights can also be used, especially in recreational areas.

Other equipment frequently used are wood 2" x 2" backstops installed (loosely) to prevent discs from rebounding back onto the court and thereby eliminate the half-round being played over. The end of the court with a scoreboard shall be designated the Head and the opposite end shall be known as the Foot of the Court. (Figure 24).

Tennis

Space

A single, double court is 36 feet by 78 feet (Figure 25). There should be 12 feet of clearance on each side of the court and 21 feet of clearance between the baseline and the fence. This would mean that there will be an area of 60 feet by 120 feet for each court. The baseline fence distance remains constant regardless of the number of courts. If several courts are placed side-by-side, the courts may be placed so that there are 12 feet between adjacent sidelines. Considering a bank of eight tennis courts, an area of 47,520 square feet would be required (120 x 396).

For ease of construction and economy, courts are generally laid out in two rows of four courts each or in a single line. When the courts are laid out in one line, the area of 47,960 square feet and its perimeter is 1092 (including a center fence between the two rows of courts). Surface area and fencing is greater with the arrangement of two rows of four courts.

A group or bank of eight courts was used merely as an example. In most private club installations, two courts for each battery is preferred because of aesthetics, reduced drainage problems, and reduced traffic.

The number of courts planned should depend on the specific needs of the school. If all courts were in use, the eight-court facility would serve 32 students. Large classes could be accommodated by having wall rebound areas and/or scheduling systems so that half of the class would be taught the tennis unit at one time.

It is recommended that courts drain from side to side. The U.S. Lawn Tennis Association suggests the slope for porous courts to be 1" in 20' to 30'; and 1" in 10' for non-porous courts.

Surfaces

The court surface can be selected from more than 100 available finishes suitable (in varying degrees) for tennis courts. The following classification of surfaces by type and

CLASSIFICATION OF TENNIS COURT SURFACES
(as established by the U.S. Tennis Court and Track Builders Association)

A. Pervious Construction
(one which permits water to filter through the surface)
   1. Fast Dry (Fine crushed aggregate)
   2. Clay
   3. Grass
   4. Others (Dirt, Grit, etc.)

B. Impervious Construction
(one on which water does not penetrate, but runs off the surface)
   1. Non-Cushioned
      a. Concrete
      b. Asphalt
         (1) Hot Plant Mix
         (2) Emulsified Asphalt Mix
         (3) Combination Hot Plant and Emulsified Mix
         (4) Penetration Macadam
         (5) Asphalt Job Mix
      c. Others (Wood, etc.)

   2. Cushioned Construction
      a. Asphalt Bound Systems
         (1) Hot Leveling Course and Hot Cushion Course
         (2) Hot Leveling Course and Cold Cushion Course
         (3) Cold Leveling Course and Cold Cushion Course
      b. Synthetic
         (1) Elastomer
         (2) Textile
      C. Others

Chart Comparing Various Tennis Court Surfaces

Court Type	Repairs May Be Costly	Glare	Av. Time Before Resurfacing	Other Uses	Surface Hardness	Ball Skid Length	Ball Spin Effective	Colors	Drying Time After Rain	Is Ball Bounce Uniform	Stains Ball	Abrasive Surface (burns skin, holes, shoes & rackets)	Humidity Problem Indoors	Slide Surface	Lines Affect Ball Bounce
POROUS															
Fast Dry	no	no	10 yrs.	yes	soft	short if damp court	yes	green	Yes (if fast	some maintained)	do	no	yes	yes	yes
Clay	no	generally	5 yrs.	yes	soft		yes	red varies	slow	Yes (if maintained)	yes	no	yes	yes	yes if tapes
Dirt	no	yes	3 yrs.	yes	soft	long dry court	yes	varies	slow	yes if maintained)	yes	no	yes	yes	yes if tapes
Grit	no	yes	3 yrs.	yes	soft		yes	varies	slow	yes (if maintained)	yes	no	yes	yes	yes if tapes
Grass	no	no	indefinite	yes	soft	moderately long	yes	green	slow	irregular	yes	no	won't grow	yes	no
Special (Porous concrete)	yes	no	3yrs. (if colored)	yes	hard	medium	yes	wide variety	fast	yes	no	yes	no	no	no
NON-POROUS NON-CUSHIONED															
Concrete	yes	no (if colored)	3 yrs. (if colored)	yes	hard	long if glossy court finish medium if gritty court finish	no if glossy finish yes if gritty finish	wide variety	fast	depends on installation	no	varies	no	no	no
Asphalt Plant Mix *(Colored)	no	no	5 yrs.	yes	hard			wide variety	fast	yes	no if colored	no if colored	no	no	no
Asphalt Job Mix (Colored)	no	no	5 yrs.	yes	hard			wide variety	fast	yes	no if colored	no if colored	no	no	no
Asphalt Penetrated Macadam	no	no	5 yrs.	yes	hard	short	yes	wide variety	fast	yes	no if colored	*no	no	*no	no
Wooden	no	no	indefinite	yes	hard	long	no	wide variety	fast	yes	no	no	no	no	no
NON-POROUS CUSHIONED															
Asphalt Bound System (Colored)	no	no	5 yrs.	no	soft	long if glossy finish, short if gritty finish	no if glossy yes if gritty finish	wide variety	fast	yes	no	no	no	yes	no
Synthetic	no	no	varies	yes	soft	medium to short	yes	green	fast	yes	no	no	no	slight	no
Synthetic Carpet	no	no	varies	yes	soft	short	yes	green	fast	yes	no	no	no	no	no
Removable	no	no	varies	yes	soft	varies, shortest to longest	yes	variety	fast	yes	no	no	no	slight	no

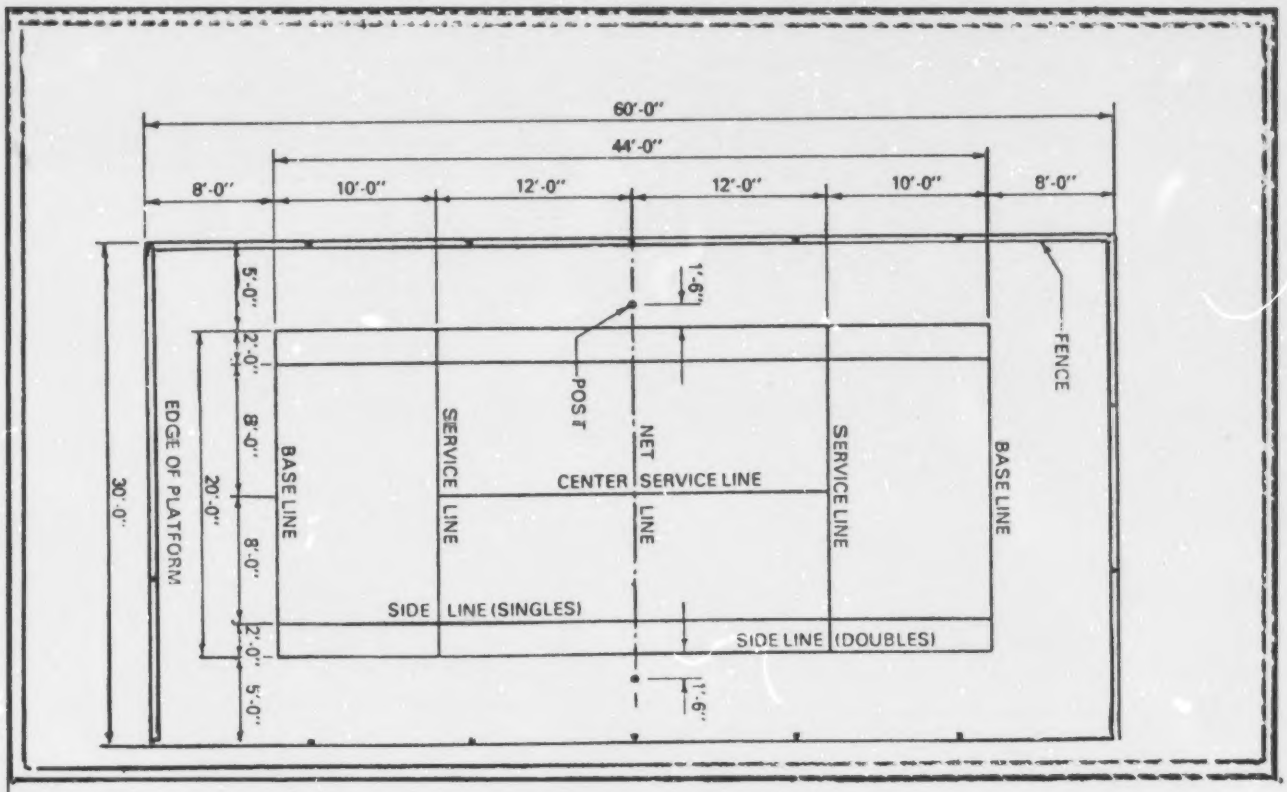
Maintenance of all Non-porous surface types is very minor. Porous types, with the exception of porous concrete (very minor) require daily and general care

characteristics is reprinted by permission of the United States Tennis Association (USTA). More detailed information regarding tennis court construction is available in the booklet, *Tennis Courts,* published by the USTA and available from USTA Education and Research Center, 729 Alexander Road, Princeton, N.J. 08540.

The court should be laid out on a north-south axis line. Care should be exercised to provide natural landscaping without creating shadows. Good lighting is essential. Platform tennis is extremely popular in cold northern locales and some of the most efficient installations locate several platforms around a small centrally located room, well heated for winter. Large windows allow waiting players to watch preceding matches in comfort.

Construction Suggestions

In staking out the space for the 60' by 30' surface, an extra 4 feet should be allowed on each side and end for the foundation beams at the corners and at the locations of the uprights. This is to enable them to project far enough to furnish a base for the outer support of the uprights. Thus, the total area needed for the foundation beams is 68' by 38'. Commonly used specifications call for 4-inch by 6-inch foundation beams across the base of the platform, resting on concrete blocks, set so as to allow a distance between the beams of 4 feet from center to center. Four concrete blocks, evenly spaced, are required for each beam. Beams of wood should be waterproofed with creosote. The planking for the deck surface should be 2 feet x 6 feet Douglas fir and should be spaced



from ⅛ inch to ¼ inch apart to allow for drainage between planks. The corner uprights are of 4-inch by 4-inch, and the intermediate uprights of 2-inch by 4-inch, all projecting 12 feet above the surface of the court, as previously indicated.

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The Backstop

Around the platform are horizontal bars known as top rails connecting the tops of the uprights and bolted to the insides of each. These rails are of 2 inches by 4 inches along the sides. Thus, the rails to which the wire is fastened project inside of the uprights, by 4 inches at the ends and 2 inches at the sides. The wiring covers all of the space around the platform except 12-foot openings in the center of each side, at least one of which is closed with either netting or light gauge wiring. This center closure is intended to contain errant balls.

All wiring should be attached inside the uprights, running vertically and stretched in 6-foot widths from the top down to the tension rail below, described in the ensuing portion. The vertical wiring is then laced tightly with light galvanized wire, or held together with clips. All uprights are set back in order to prevent the balls from striking against them and rebounding unevenly.

At the bottom parallel to floor and a few inches above it, adjustable bars of 2 inches by 4 inches are provided and bolted below through the platform with half-inch by 16-inch bolts. By adjusting these bolts, which raise or lower the tension bars to which the wiring is attached, the wire can be kept tight and at uniform tension. Both sides and ends are similarly adjusted. The sides are set forward only 2 inches, due to being struck only glancing blows and requiring less clearance accordingly.

The Wire

The wiring at the ends of the platform should be 1-inch mesh, 16 gauge chicken wire, though the sides need be on 1½-inch mesh to be satisfactory.

The Net Posts

Net Posts of 3-inch by 3-inch, 37 inches in height are set up

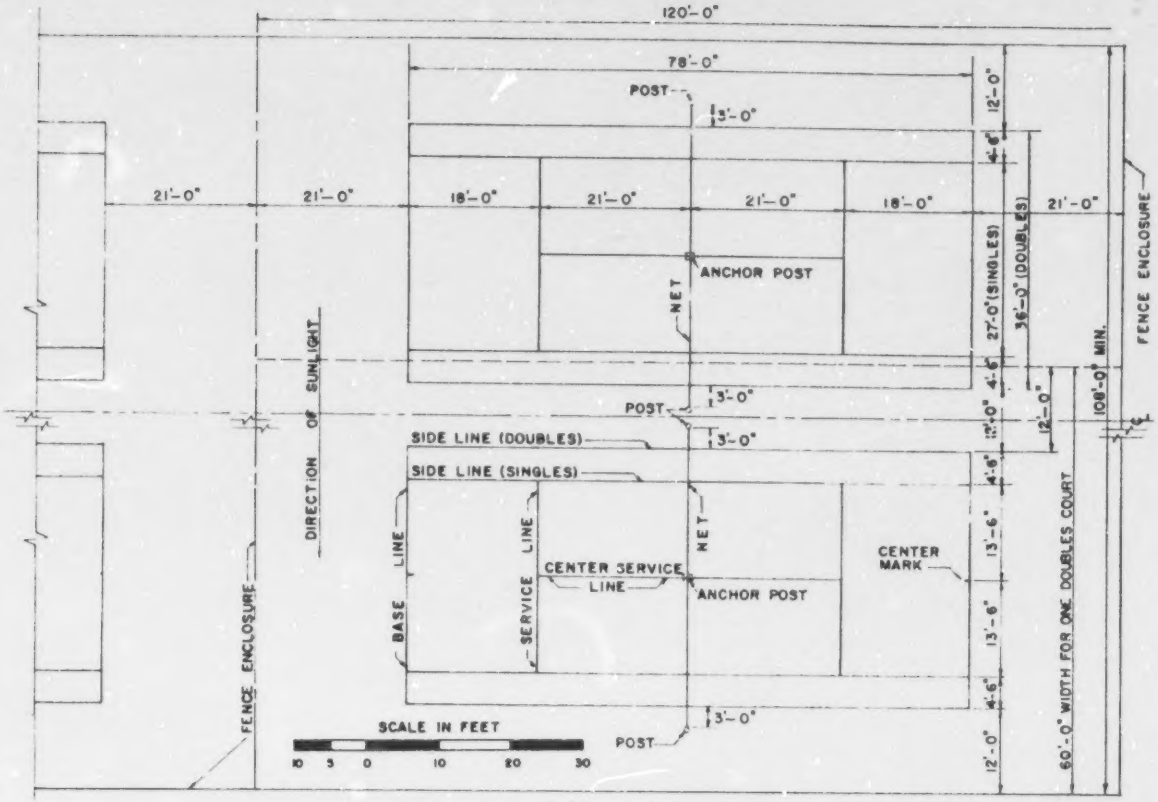


Figure 25
Tennis Court Layout

Figure 26
(Below)

Courts at Middle Tennessee State University

3 feet from the center of each side line of the playing surface, braced by four angle irons screwed into the court and by a supporting 2-inch by 3-inch beam diagonally angled inside.

The Paint

A quality paint job is important for looks, durability, sufficient reflection of light during night play and ability to absorb and hold enough sand to give the required non-skid surface. Many installations fail to consider this last point and as a consequence lost many playing hours following inclement weather. Light green is considered best for over-all play. It tends to remain light enough after application of sand. Care should be exercised to apply fairly thick coats to absorb the sand. A good rule of thumb for the amount of sand to be applied is: Too much is better than too little. Sand will wear away quickly. Between 50 and 100 pounds of sand per court should be applied to the wet paint.

Volleyball

Although outdoor volleyball is gaining in popularity, the required dimensions are identical to the game played indoors.

Track and Field

The planning of a new track and field facility or the remodeling of an existing one should begin with a study of the International Amateur Athletic Federation rules on track and field facilities. National Collegiate Athletic Association and National Federation of State High School Athletic Association rules on track and field facilities generally conform to IAAF rules but should be consulted for possible deviation.

Marking

An all-weather track should only be marked with a paint compatible to the surfacing. The best means of insuring this compatibility is to use the paint recommended by the track surface manufacturer. A non-compatible paint can cause, among other things, peeling and cracking.

Relay zones and staggers should be located by survey. The engineering firm responsible for installation of the track and their surveyor should certify, in writing, that measurements are exactly as required in the track and field rules. Various colors may be used for each set of markings.

The start and finish line for all races run around the track should be located approximately 15 meters from the bend of the first curve. A curve starting line for all races not run in lanes must be included in the markings. (See Figure 28).

Drainage

The track should shed water to the inside. Small curb openings permit the water to drain from the track. Since the area just inside lane one is usually used for warm-up and jogging, the drain field ditch should be located about 6 to 8 feet inside the track.

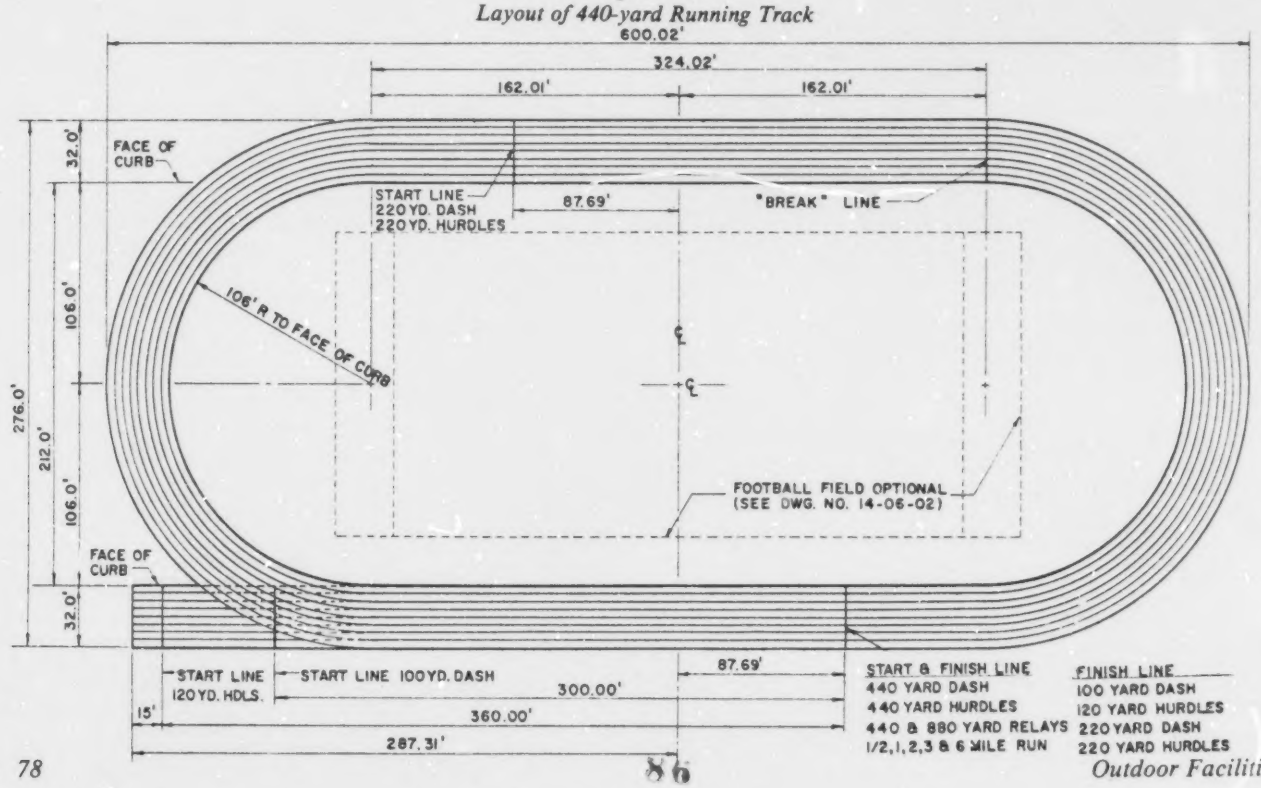
The Steeplechase

The steeplechase water jump will be located on the inside edge or outside edge of the track. Running surface off the track and back again must be provided. If the water jump is on the inside of the track, a removal curb will be necessary. Plan for drainage and locate water connection near the water jump pit.

The High Jump

The high jump approach area should provide 22 meters of level surface (21.3 meters required by rule) from any angle within an arc of 150 degrees. The arc should be of synthetic material, usually the same as the track. The high jump pit

Figure 28
Layout of 440-yard Running Track



Lane Measurements

Distance from Start-Finish Line to Star Line for that Lane

One Turn Stagger		*Two Turn Stagger*	
Lane	Distance	Lane	Distance
1	0 feet	1	0 feet
2	11.52 feet	2	23.05 feet
3	24.08 feet	3	48.17 feet
4	36.64 feet	4	73.29 feet
5	49.20 feet	5	98.41 feet
6	61.76 feet	6	123.53 feet
7	74.32 feet	7	148.65 feet
8	68.88 feet	8	173.77 feet

Hurdles

Distance of Race	Height of Hurdles		Distance from Start to First Hurdle	Distance Between Hurdles	Distance Last Hurdle to Finish
Yards	*Ft.*	*In.*	*Yards*	*Yards*	*Yards*
120	3	6	15	10	15
440	3	0	49¼	38¼	46½

Relays

Run-Up Zone	Exchange Zone
10 meters	20 meters

must be a minimum of 4.88 x 2.44 meters and of a composition to provide a safe landing (no bottom out) (Figure 36).

The Pole Vault

The vaulting box must meet the IAAF specifications and be immovable. The pit shall be a minimum of 4.88 meters wide and 3.66 meters deep. The pit should be made of sponge rubber and have a height of 91.44 centimeters (36 inches). The vaulting runway must be a least 38.1 meters in length (45 meters is a desirable length). Locate the pole vault so that the prevailing wind will be at the vaulters' backs (Figure 37).

The Long Jump and Triple Jump

The minimum length of the runway of long jump and triple jump is 39.62 meters, but 52 meters is desirable if the triple jumpers are to have sufficient runway. If possible, the location should place the prevailing wind at the jumpers' backs, or to the side, but not head-on.

The landing pit shall be sand. It is not less than 2.74 meters in width and usually 10 meters long. The pit elevation must be identical with the take-off board.

The take-off board for the long jump must be at least one meter (four meters recommended) from the near edge of the pit and ten meters from the far end of the pit.

The take-off shall be from a board 20 centimeters wide and at least 1.22 meters long. The board must be immovable (Note: painting a take-off area on the runway does not satisfy this rule).

In the triple jump, the nearer edge of the landing pit to the take-off board shall be 10 meters for high schoolers and 12.5 for collegiates. A 10.97 meter scratch line could be used by the better high school athletes and the younger collegians (Figure 35).

Throwing Circles

Portland cement concrete is the recommended material for throwing circles. Brushing the concrete while it is setting produces small ridges which aid in preventing slipping. A band of angle iron or steel is to be set flush with the concrete outside the circle.

The inside diameter of the shot put and hammer circles is 2.135 meters. The diameter of the discus circle is 2.5 meters. The metal circle shall be six millimeters in thickness and two centimeters in height. The metal circle must be firmly secured and flush with the throwing surface.

The discus circle should be located so the athletes throw into the prevailing wind.

If the hammer is to be thrown, a cage must be set up around the ring to ensure safety (the rule books contain a recommended design).

The Javelin

Figure 34 illustrates the javelin throw layout and detail of the javelin throw scratch board.

Archery

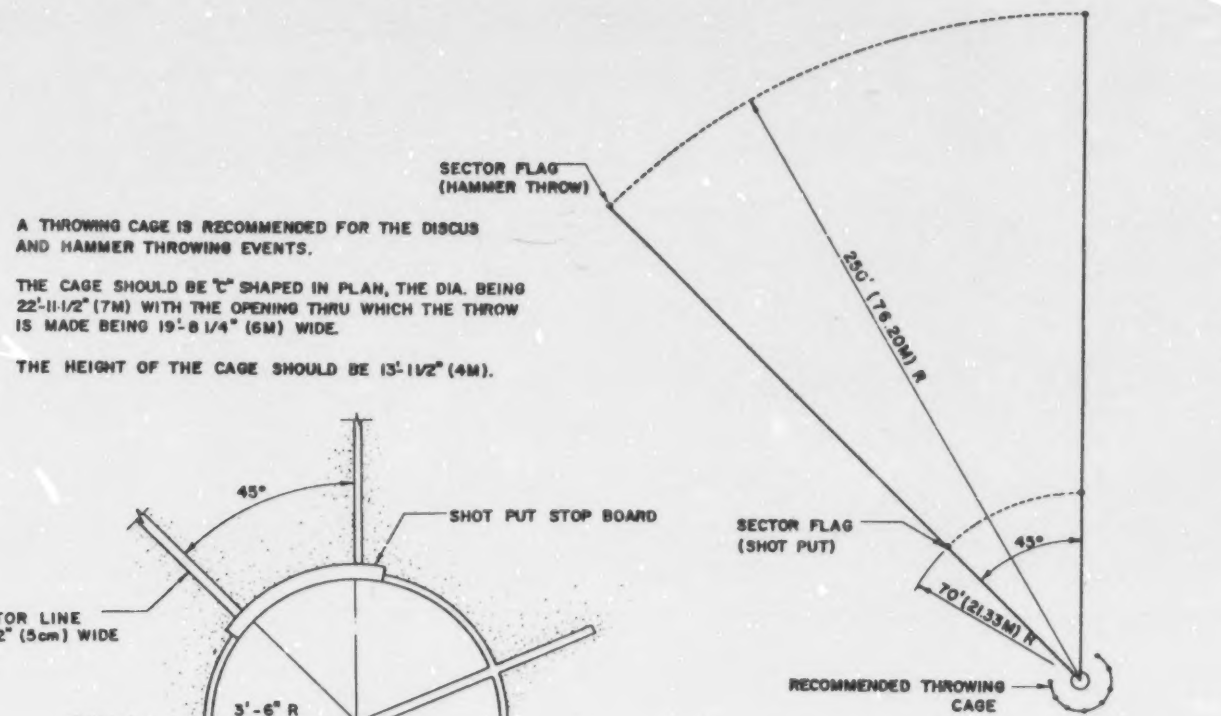
Today, the teaching of archery and competitive archery takes place both indoors and outdoors. Indoor archery is discussed in Chapter 2. Factors such as weather, type of program, terrain, space, and costs are considerations to be taken into account when developing an outdoor archery range.

While the emphasis in this section is on outdoor instructional archery, additional information on indoor archery (Chapter 2) and recreational archery (Chapter 7) should be consulted. An outdoor archery range layout is included in Figures 28 and 29, Chapter 7. For added breadth to an archery program, consideration should be given to the competitive rounds of various organizations. Those archery activities that would require special areas are:

- Field archery range - According to the National Field Archery Association, a field course is designed in units of 14 targets each, requiring from 50 to 10 acres per unit, depending on the terrain. Two units or 28 targets, compose a Round. the shooting distance ranges from 20 feet to 80 yards.

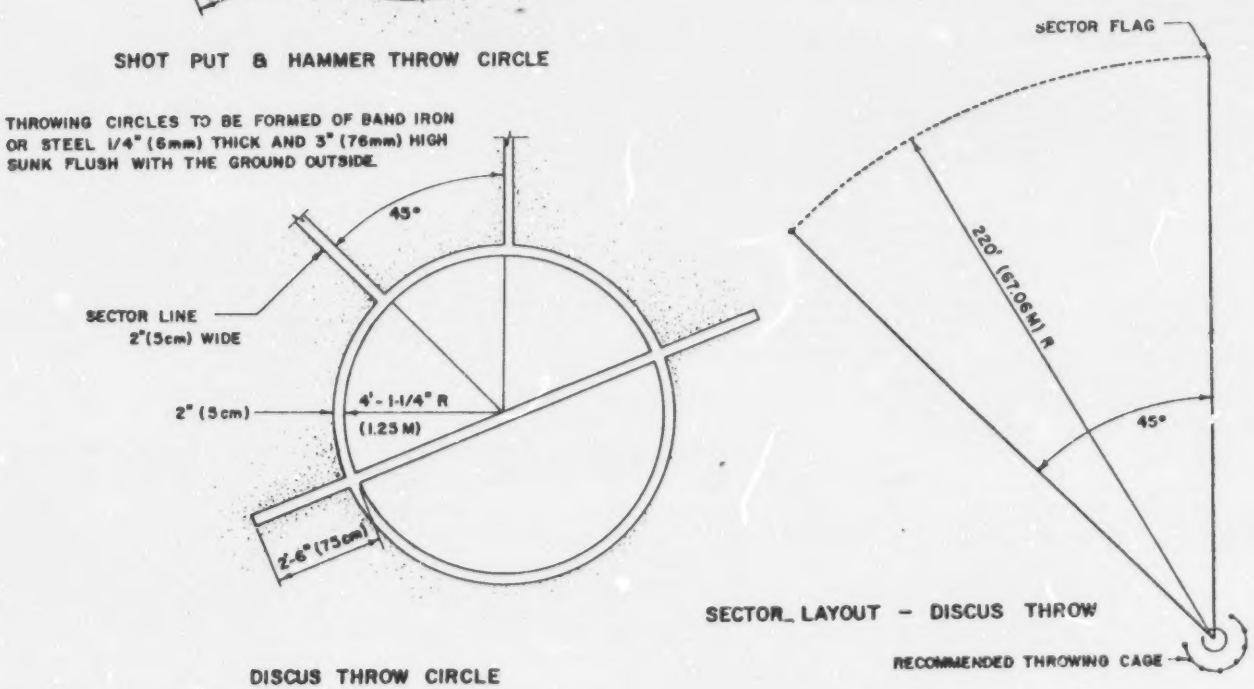
Figures 29,30,31,32, and 33

Layout details for weight events, including shot put, hammer and discus throw. (All detail drawings for track and field events provided by U.S. Army Corps of Engineers.)


SECTOR FLAG
(HAMMER THROW)
A THROWING CAGE IS RECOMMENDED FOR THE DISCUS AND HAMMER THROWING EVENTS.
THE CAGE SHOULD BE "C" SHAPED IN PLAN, THE DIA. BEING 22'-11-1/2" (7M) WITH THE OPENING THRU WHICH THE THROW IS MADE BEING 19'-8 1/4" (6M) WIDE.
THE HEIGHT OF THE CAGE SHOULD BE 13'-1 1/2" (4M).
250' (76.20M) R
SECTOR FLAG
(SHOT PUT)
45°
70'(21.33M) R
RECOMMENDED THROWING CAGE
45°
SHOT PUT STOP BOARD
SECTOR LINE
2" (5cm) WIDE
2" (5cm)
3'-6" R
(1.067M)
2'-6" (75cm)

SECTOR LAYOUT - SHOT PUT & HAMMER THROW

SHOT PUT & HAMMER THROW CIRCLE

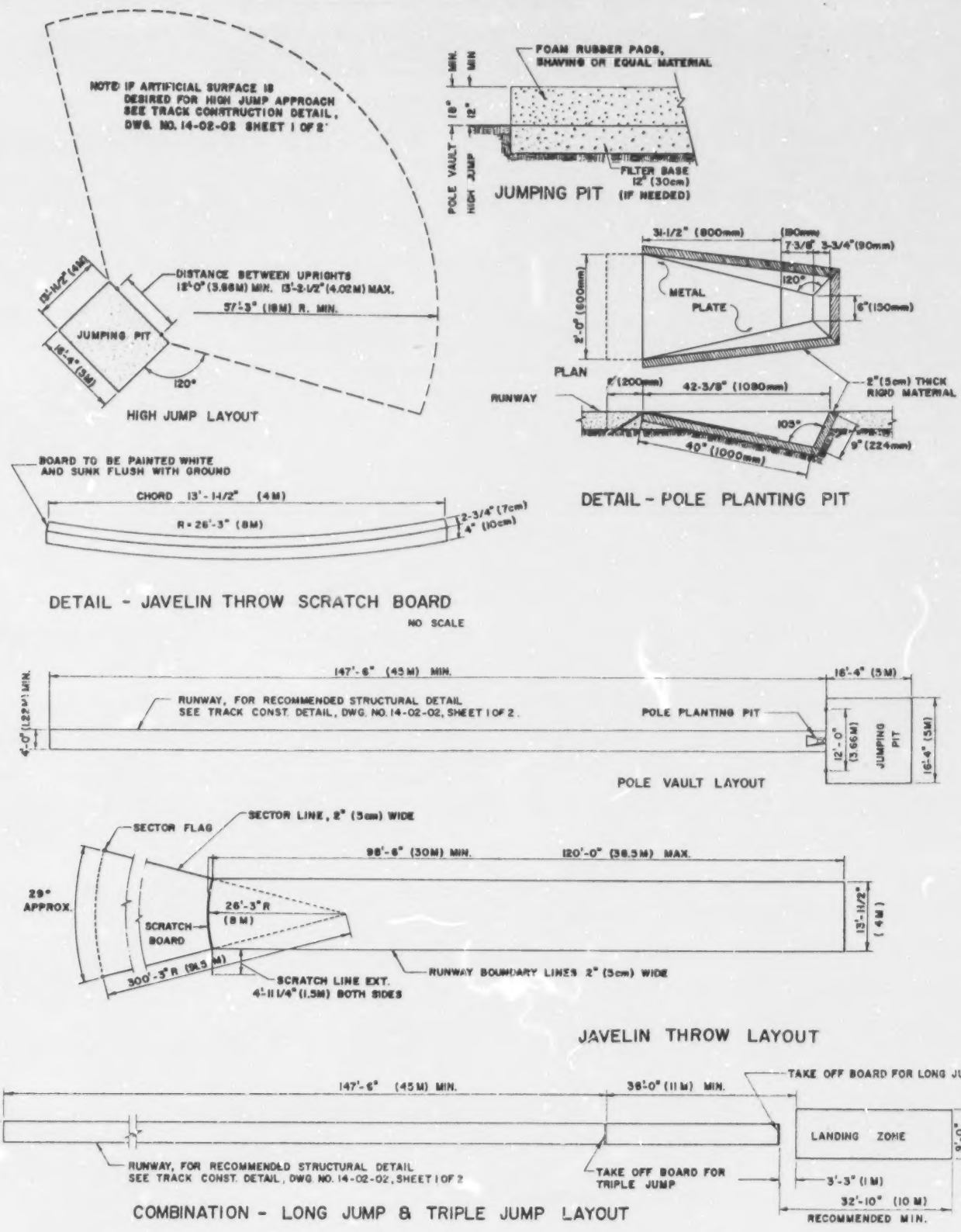


SECTOR LAYOUT - DISCUS THROW

DISCUS THROW CIRCLE

Figures 34,35, and 36

Layout details for high jump (and long jump and triple jump), poie vault and javelin throw.



- Clout shooting requires approximately 300 yards with the regulation distance for women at 120 and 140 yards, and for men 180 yards.
- Archery-golf can be set up on a golf course or on existing large intramural fields. Dimensions can be established according to available space, keeping in mind the importance of providing sufficient space to insure the safety of participants and passersby.
- Competitive archery rounds. The variety of rounds varies greatly in distance, targets, and scoring. Consideration should be given to providing a range large enough to accommodate the FITA round. The longest shooting distance for the FITA is 90 meters for the men's round.

To insure a safe range, space should be provided beyond the target line, free from stones and other substances that cause the breakage of arrows falling beyond the target.

If a backstop is used, it should be of a "see-through" type (i.e. a nylon net) to enable the instructor to have complete visibility behind the target line. Posts on which the net is hung should be approximately 25 feet apart. The net should be hung from a heavy wire (No. 8 clothesline). The recommended net height is 10 feet.

When shooting from beginning distance (20 feet to 20 yards), there should be a minimum of 30 yards clear behind the target if no backstop is used. A hill is a natural backstop, but care should be taken to prevent anyone from wandering over the hill while class is in session.

When existing outdoor areas serve several activities, an archery range can be placed on one of several school sites: football field, practice field, hockey field, playground, or tennis court.

The overriding concern when an area of multiple use is used should be safety. To this end, grass or dirt surfaces are preferable to hard surface areas.

Targets

The type of target used is determined by the range and the round to be shot. Often the targets need to be taken in at the end of the day requiring portable targets.

Non-Permanent Targets

When targets must be installed and removed for each archery class, the movable kind is recommended. They can be set up in the following manner:

Pipes that are two feet long and 1½ inches in diameter should be spaced 38 inches apart and driven into the ground until the top end of each pipe is slightly below the surface of the ground.

Prior to each class, the instructor and/or students can insert a pipe or stake that is 5 feet long and 1 inch in diameter into each of the recessed pipes and secure the target matts to the pipes or stakes by attaching two wire loops on each side of the matt and sliding the loops onto the pipes or stakes.

If desired, the recessed pipes can have a threaded end so that a cap can be placed over the pipe opening. This will prevent rain and debris from falling into the pipes when the range is not in use.

Commercial movable target stands can also be used. Tripods can be used, although they are more cumbersome to transport and set up. In an outdoor range, the tripods should be anchored. Another idea for target stands is to use track hurdles upside down and wire the matts to the legs.

Permanent Targets

Permanent targets can be installed in the following manner:

Each target will require two supports. The supports should be approximately 6 feet long and can be of the following materials: 1-inch pipes, 2½-inch cedar posts, 2- by 4-inch wooden stakes, or steel fence posts. Stakes should be driven into the ground 38 inches apart and to a depth of at least 2 feet. An old rubber tire or 2 by 4s should be placed on the ground between the two supports.

The bottom bale of excelsior or straw should be placed on top of the tire or 2 by 4s so that it does not rest on the ground. This preserves the bales and eliminates arrows from sliding underneath. Two more bales should be stacked on top of the first, and all three bales should be banded together by using a banding tool or two straps of No. 8 wire. This is done by completely encircling the bales and tightening the wire. If four or five bales are desired, the target supports should be within 6 inches of the top. Supports should never extend higher than the tops of the bales.

When using the metal supports, it is best to cover the surface of the supports with heavy rubber, such as old car tires, bicycle tires, or rubber hose cut in half lengthwise. To protect excelsior or straw bales from too much water, the top bale should be capped with a protective covering of plastic or roofing paper.

A shooting line can be indicated by marking compound or with a rope or measuring tape stretched between stakes. The stakes should be placed directly in front of each target. For a permanent range, cement or patio blocks, bricks, or similar blocks can be recessed into the ground to indicate shooting positions. The distance from the target face to the shooting position may be painted on the face of the block.

The Archery Manufacturers Organization has designed a sheltered archery range that provides the maximum safety for a cost comparable to a doubles tennis court.

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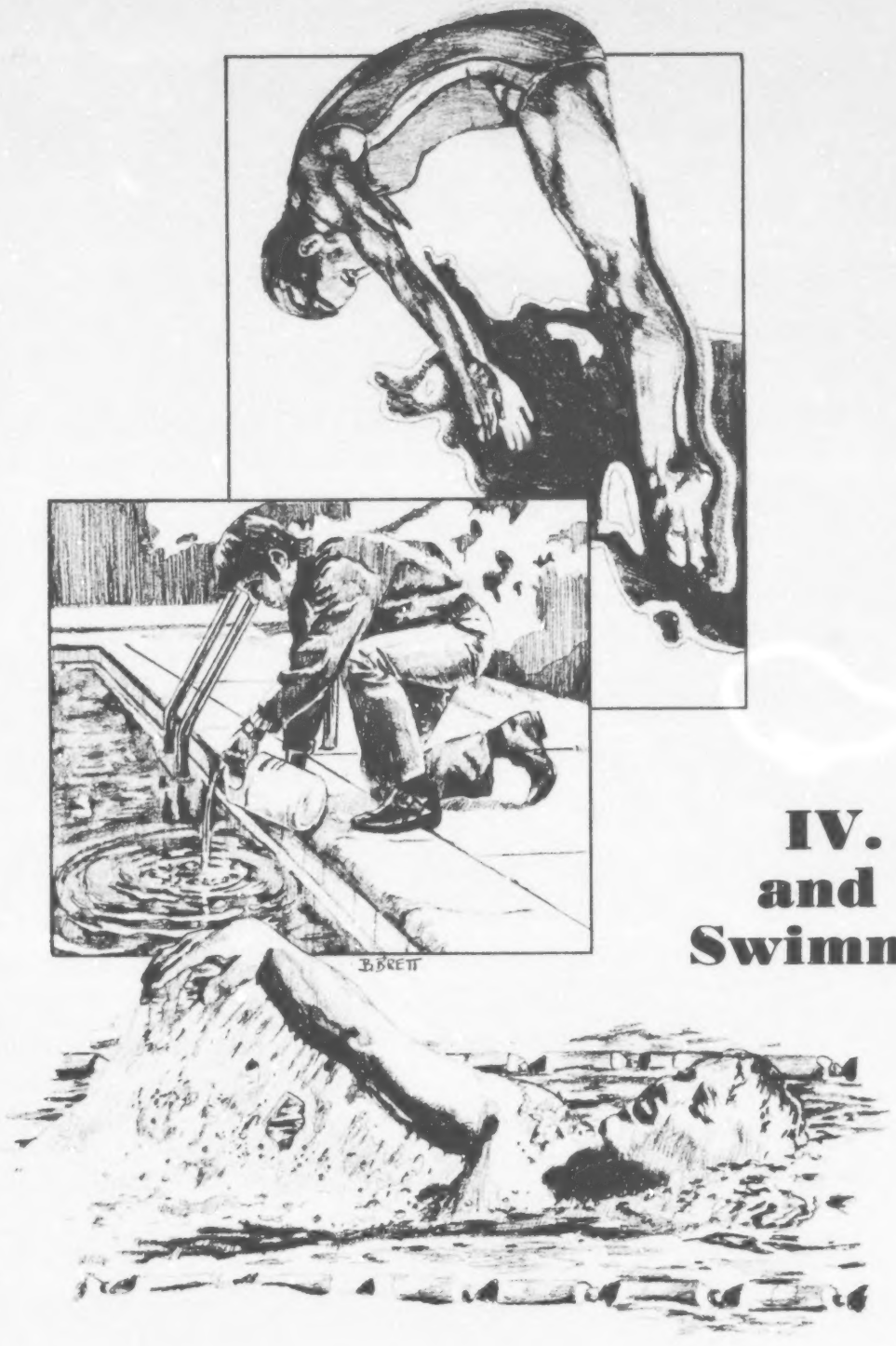
Selected References

(Refer to REFERENCES section in Chapter II, INDOOR FACILITIES and Chapter VII, RECREATION AND PARK AREAS AND FACILITIES.)

A complete annotated bibliography appears in the appendix.



IV. Indoor and Outdoor Swimming Pools

Indoor and Outdoor Swimming Pools

Pool drawings by A.G. Thomas

THE VAST EXPANSION in aquatics in the United States during the past three decades places new demands on planners of facilities for athletics, physical education and recreation. General considerations in pool planning and construction are normally the same for aquatic facilities in schools and in communities. This chapter has been designed to aid pool planners in designing facilities that will meet the present and future needs for instruction and recreation.

Design and Purposes

Aquatic facilities can be designed for special programs or general use. Some programs require specific construction features. Others can be conducted in nearly any body of water.

Most communities and institutions must plan for versatility in program because of economic limitations. Therefore, the focus of this chapter will be on planning a pool complex to be used for the most complete aquatic program.

A complete aquatic program includes swimming instruction, competitive speed swimming, synchronized swimming and aquatic shows, water polo competition, springboard diving, SCUBA diving, aquatics for the handicapped, small craft instruction, and recreation. All these activities require specific pool design characteristics.

Planning Considerations

Those involved in planning pool construction should consult the references listed at the end of the chapter for the latest information on the subject.

Design

The pool activity which imposes more requirements and restrictions on design than any other is competitive speed swimming. Fortunately, a pool designed for competition is adequate for most other activities, but a pool designed for any other use is likely to be inadequate for competition. It is suggested that the most versatile pool be planned to meet competitive speed swimming specifications with modifications to accommodate other programs.

The current trend toward adoption of the metric system in this country complicates the pool planning problem, but at least two alternatives exist for allowing a smooth transition. The pool can be designed with metric measurements in one dimension and U.S. measurements in the other, or a movable bulkhead may be employed to allow instant conversion from one system to the other.

Movable bulkheads, properly designed, offer the greatest degree of versatility in swimming pool program planning.

The design program, when completed, should represent a careful balance of such factors as pool size, program dimensional requirements, sub-soil conditions, filtration plant economics, advantageous shell construction, imposed budgetary restrictions, future expansion possibilities, code regulations, possible operational program changes, and imposed site or technical limitations that will affect the final pool design. The pool professional, engineer or architect, is charged with preparing plans and obtaining bids for a project after the design program is formulated by the planning committee. A swimming pool consultant who has adequate experience in pool programming and pool management should be employed for advice on pool layout and special features. Such advice can often help to avoid the many mistakes so costly in terms of program restriction and economical operation of the pool. In all states, pool plans must be submitted to local or state health authorities for approval before construction.

Final determination of the safe pool load (using the recommendations in Table 1.) can be established by considering the supervision available, the method of instruction, and the nature of the activity being conducted. For example, one instructor with no assistance should supervise only 20 to 25 non-swimmers in a class.

Purity and clarity of the pool water must be insured by proper planning for chemical treatment and filtration. Fortunately, modern pool designers and public health officials are

Table 1
Minimum Recommended Occupancy Design Factors

ACTIVITY	AREA REQUIRED
Shallow Water Area (under 5'0")	
Recreational Swimming	15 sq. ft./capita
Advanced Swimming Instruction	25 sq. ft./capita
Beginning Swimming Instruction	45 sq. ft./capita
Deep Water Area (over 5'0")	
Recreational Swimming	25 sq. ft./capita
Diving (based on area within 30 ft. of deep end wall and 12'0" deep)	400 sq. ft./capita

	Indoor Pools	Outdoor Pools
Minimum Walk Width	8 ft.	12 ft.
Sum of walk dimensions on both sides or both ends of pool	24 ft.	30 ft.

(Walk dimensions shall be horizontal clear deck width not including any portion of the coping or interior gutter sections.)

changing the required standards for filter size to reflect the increasing popularity of aquatic sports. Many operators of older pools are finding that filter size and turnover requirements for the time the pool was built are inadequate for the heavy use imposed on the pool today. Most health departments now require filters of adequate size to filter the entire pool capacity in 6 hours, producing a turnover rate of 4 per day. Where heavy patronage or unusual factors are expected it is best to design the pool with a 4-hour turnover to insure water clarity and prevent costly shut-down time.

If a pool is to be used for competition it must be *no less* than 3½ feet deep at the shallowest point within the competitive course. Most coaches prefer a minimum depth of 4 ft. A compromise of 3 feet, 9 inches works well for competitive swimmers and provides water shallow enough for instruction for elementary school children.

The ratio of shallow (under 5 feet) water area to deep (over 5 feet) water area depends upon the pool size and program considerations. If springboard diving is to be part of the program it is essential that a safe diving depth be maintained for a distance of 20 ft. from the deep end, and that the slope up to 5 ft. depth shall rise constantly over a distance of 12-14 feet. Thus, a pool of 25 yds. (or 25 meters) standard length would contain 32-34 ft. of deep water and 41-50 ft. of shallow water. Any smaller diving area would be unsafe unless the diving board were mounted on the side of the pool (See pool layout drawings: Figures 4, 4-A).

Deep water is also required for life saving instruction, synchronized swimming, water polo, and SCUBA instruction. The ratio of shallow water to deep water must take into account the relative importance of these program components.

Diving boards should always be mounted at heights of 1 and 3 meters from the board surface to the water surface. They should be mounted a minimum of 12 ft. from the pool edge and at least 10 ft. from the next board, measured center to center. A 15 ft. distance between boards, or between board and side wall is preferred.

Pools built to include competitive speed swimming programs should always exceed the standard course length specified by 1 inch or 2½ centimeters to allow for workmanship tolerances and for installation of electronic timing touch pads.

A multiple-pool complex is the only complete solution to meeting total program requirements, though pools with movable bulkheads are a more economical compromise. The ideal multiple-pool complex would consist of a deep water (6-14 ft.) pool for competition, synchronzied swimming, SCUBA, water polo, and springboard diving; a mid-depth (3-4½ ft.) pool for swimming instruction, and a shallow (½-3 ft.) pool for small children.

Figures 2-7 represent layout designs for minimum pools, compromise pools, and ideal pool complexes.

The Program

The pool planning committee should carefully review the program requirements before attempting to determine the kinds of aquatic facilities needed. The list below suggests program possibilities which may aid planning groups in the development of aquatic facilities. Some, but by no means all, of the specific requirements for each activity are listed.

Activity	*Specific Requirements*
Swimming instruction for pre-school children.	Water 6" to 3' deep, capability to warm water to 86°.
Swimming instruction for elementary school children and adults at all levels from beginner through advanced. Instruction in Life Saving and Water Safety.	*Water 3'9" to 4'6" deep,* temperatures 80° to 84°; 45 sq. ft./person.
Synchronized swimming, aquatic art	Water at least 5' deep for a straight distance of 50' or more, some water of 10' depth At least 30' x 60' of water 10' deep, plus some shallow water. P.A. System, special lighting capabilities. Special pool wall marking for underwater orientation. Underwater loudspeakers. Spectator seating.
SCUBA Instruction	Water from 4' to 12' deep, preferable to 15'. Underwater speakers and underwater windows are helpful. Special storage area needed.
Swimming for the Handicapped.	Water depth to 6', depending on age. Water temperature capability to 92°. Ramp entries into pool, wheelchair entry from parking lot to pool deck through locker rooms and showers. Special showers and toilets. Hoist at poolside. Handholds at water level. (Refer to Red Cross text on Adapted Aquatics.)

Springboard Diving	16' boards of 1-meter and 3-meter heights. Ceiling ht. 16' above board level. Water depth 12' to 16' from 6 ft. back to 20 ft. forward of end of board. 10 ft. to 15 ft. between boards and 12 ft. between board and side of pool.
Competitive Speed Swimming and Diving	Special pool dimensions and markings. Depths from 3'9" to 14'. Float lines, backstroke and recall line anchors. Storage area, spectator space, team locker rooms. Special consideration of water inlets and underwater lights. Starting blocks. Special gutter systems and recirculation requirements. (See current High School, N.C.A.A., A.A.U., N.A.G.W.S. Rule Books.)
Recreational Swimming	Adequate provision for supervision. Special apparatus anchoring systems for game equipment such as volleyball nets, basketball baskets, polo goals. Storage areas for game equipment.
Boating, Canoeing, Sailing Instruction	Largest possible clear water area more than 4' deep. Movable bulkhead facilitates enlarging areas. Storage for boats.
Water Polo Competition	Special markings on pool side walls. Provision for installing goals, spectator space, storage provision for goals. All deep area 25 yds. or 25 meters by 45'. Adequate deck area for officials.

Location of Specialized Areas

If a multi-pool complex is being planned, the placement of the pools in relation to each other and to other facilities is important. The shallow-water instructional pool should be located in the area adjacent to the competitive pool. It should be located conveniently in terms of shower rooms, drying rooms, locker rooms, lavatories, and classrooms. Access by handicapped persons should be facilitated.

The indoor deep-water competitive pool should be at ground level, with convenient spectator access to corridors and exits so that audiences may come and go without traversing the pool deck or the rest of the building. Spectator site lines are extremely important since this pool will also be used for synchronized swimming competition, water shows and interscholastic or intercollegiate water polo games. This pool should be adjacent to team rooms, storage areas, locker rooms, classrooms, and the shallow-water pool.

The indoor diving well should be in the same spectator area as the competition pool, but separated from it by a permanent wall or movable bulkhead. Where possible, the diving boards should run parallel to the spectator seating. (See multi-pool complex drawing.) Spectators should be elevated above the pool deck by placing them on a balcony at least 6 ft. above the pool deck. If access to the pool deck is necessary, it should be limited and controlled.

Recommended Features (General)

- Rectangular shape for pools
- Cove corners to facilitate cleaning
- Acoustically treated walls and ceilings
- Humidity control
- Separate temperature controls for spectator area
- Central office with bay-type window providing observation of entire aquatic area
- Entrance to office from outside corridor not in general student traffic lanes
- Separate ventilation system for office
- All ladders recessed into pool wall, with a minimum of two on each side of each pool, three feet from end walls. None in end walls.
- In diving wells, ladders may be placed on end walls, but should not be recessed, and should be easily and quickly removable.
- Drinking fountains and cuspidors in each area
- All decks and floors of 1-inch non-skid tile
- Telephone in wall receptacle at each end of natatorium
- Separate cut-off system for class bells if located in natatorium
- Distance markings on pool edge in yards and meters
- Depth markings on sides and ends of all pools
- Bulletin boards, 10' x 20' in *each* pool area
- Electric wall clock with large second hand in each pool area
- Underwater windows at least 4' x 3', in side wall of each pool. In deep-water pools, top of window a minimum of 3'6" below water surface, and 10' from end wall
- Consider building the pool without windows. Glare or reflection from windows is a major problem for instruction or for guarding of pools. Skylights directly above the pool cause less problems than windows. If windows are used, keep them small and as high as possible.
- Consider a system of drapes or blinds to cover all windows and/or skylights to eliminate reflection on the water while teaching, to darken the pool for afternoon or early evening water shows, and to allow movies in the pool area during some classes.
- Vacuum cleaning system for pool bottom
- Traffic pattern such that patrons must pass through shower rooms between lockers and pool, and between toilets and pool
- Recommended deck space ranging from 10 to 20 feet on each side and ends of pool will
- Water inlets on end walls must be flush-mounted and located directly under float line attachments.
- Underwater lights on end walls must be at least 4 ft. below the water surface, and must be on a separate switch.
- Adequate clear wall space for mounting scoreboards and large record boards. Space for large wall pace clocks exactly opposite the ends of the race course on side wall.
- Built-in capability for through-deck wiring for electronic timing systems and scoreboard.
- Public Address System and adequate microphone con-

nections (one at each underwater window, also)
- Special wiring and attachments for special lighting for shows, and for attachment of scenery to walls and ceiling
- Precise water temperature control for competitive pool
- Wall receptacles for plugging in underwater speakers

Additional Features (Diving Wells)

- Recessed ladders in side walls 5' beyond the end of diving boards
- Removable ladder on end wall midway between diving boards
- System for water surface agitation beyond end of diving boards (bubble or spray)
- Pools built specifically for diving should be a minimum of 14' deep to a maximum of 18' deep
- Ceiling height 16' above highest board and 11' above highest platform
- Guard rails on all diving boards. Extend to water edge
- Boards extend 6' to 7' over water
- Consult "Diving Facilities" drawing

- Separate filter and heating systems to allow different water temperatures in diving well and swimming pool

Additional Features (Instructional Pool)

- Separate filter and heating system to maintain water temperature at 83-84 degrees. Capability to 90 degrees for handicapped and pre-school
- Entrance ramp recessed off side of pool for wheelchair entry. Deck hoist for handicapped swimmers
- Ramp, if large enough, can be used as instruction area for pre-school children.

Recirculation and Filtration System

All modern pools are equipped with a recirculation and filtration system. Filters fall into three general classes: sand, diatomaceous earth, and cartridge type filters. Rapid-flow and high-rate sand filters, and cartridge filters are of the pressure system type. Diatomaceous earth filters can be of either pressure or vacuum system types. The flow in these systems can be reduced to the simple schematic diagrams shown in Figures 8 and 9.

Each system includes a pump for moving the water and piping to take the water from the pool and pass it through the filter and treatment units before returning it to the pool. Local and State sanitary codes must be consulted for requirements.

In the sand filter systems, water impurities are held on top or within the media bed. A coagulant floc may be used to remove extremely small particles. The system is cleaned by reversing the flow and backwashing the bed.

Cartridge type filters are composed of permeable cylinders of fibrous material which traps particulate matter as the water passes through. They may be cleaned by backwashing, or by removing and cleaning the cartridges.

Diatomaceous earth (diatomite) filters remove particulate matter as the flow passes through a thin layer of diatomaceous earth which is held by water pressure against a woven cloth or metal mesh element. When the layer of media becomes clogged, the filter is cleaned by sluicing the elements with water until the media is washed away. A fresh layer (precoat) of diatomite is then placed on the elements and the filter is returned to service. During the filter cycle, the element coating is kept porous longer by the addition of small amounts of diatomite slurry to mix with the dirt from the pool.

In all cases, flow rates and filter sizes should be calculated to produce a minimum turnover of 6 hours. Exceptionally heavy use may require a turnover rate of 4 or 5 hours to insure maximum water clarity.

Chemical Equipment

Careful consideration should be given to pool chemical equipment. High quality, heavy duty equipment should be purchased. It is this equipment along with the filter system and cleaning system that will keep the pool water chemically balanced and clean. Always follow the manufacturer's instructions carefully and have a thorough understanding of all equipment.

For large pools which get year-round use automatic controls for water chemistry may lower maintenance cost by holding chlorine and PH at precise levels.

POOL SHELL EQUIPMENT

Gutters and Skimmers

Pools use gutter systems and skimmers for removing surface water. Gutter designs include deck-level, recessed, and semi-recessed. Pool consultants, health officials and swimming coaches should be consulted in determining what is best suited for the particular installation.

Inlets

Pool water is returned from the filters at different locations through connections in the pool shell. Inlets can be set either in the wall or in the pool floor. Wall-mounted inlets should be flush-mounted and should be placed only directly under floatline attachments if they are necessary in the end walls of competitive pools. Local and state codes should be consulted for requirements.

Drains

Drains are located at the pool bottom for the collection of deep-end water and for emptying the pool. Usually, a removable grate is set in a frame, flush with the bottom of the pool and firmly secured in place so it cannot be removed by swimmers.

Main drains are also used as pool-water returns, similar to an inlet, and styles to accommodate these systems are available. Perforated drains are desirable for safety. Drains should never be set directly below the diving trajectory. Local codes set standards for the size of the drains.

Hydrostatic Relief Valves

Hydrostatic relief valves can be the most important shell equipment provided. Every pool, when empty, is essentially a boat hull. Water beneath the hull tends to cause the pool to float. Hydrostatic relief valves relieve external water pressure on the pool shell.

Alarm Systems

Alarm systems for indicating the presence of persons in the water when the pool is closed and unsupervised can perform an important watchman service.

Illumination Systems

Underwater lighting must be installed in accordance with

Growth of Swimming Pools by Type

Classification, by Use and Ownership — Totals Are Cumulative

	Jan. 1 1978	Jan. 1 1977	Jan. 1 1976	Jan. 1 1975	Jan. 1 1974	Jan. 1 1973	Jan. 1 1972	Jan. 1 1970	Jan. 1 1968	Jan. 1 1966	Jan. 1 1964	Jan. 1 1960	Jan. 1 1958	Jan. 1 1948
Hotel, Motel, Apartment	199,610	196,785	193,150	188,300	181,100	170,000	158,000	136,300	112,800	92,450	69,350	32,600	14,200	600
	2,825	3,665	4,850	7,300	11,000	12,000	9,000	12,800	9,550	11,100				
Clubs, (city, country, health, commercial cabana and beach, etc.) and neighborhood groups	56,275	55,650	55,250	53,100	50,500	48,100	45,900	43,450	39,650	35,350	29,100	16,900	7,500	1,100
	625	400	2,150	2,600	2,400	2,200	1,250	2,100	1,900	2,850				
Municipal, County, Community and other governmental plus neighborhood & community	48,505	47,765	46,350	45,150	42,750	42,050	41,150	39,350	36,150	32,850	29,200	19,300	12,800	4,000
	740	1,435	1,200	2,400	700	900	1,000	1,700	1,400	1,750				
School, College, "Y", Institutional	30,360	29,800	29,400	28,800	27,400	26,100	25,100	23,100	20,300	16,800	14,400	10,600	8,900	2,400
	560	400	600	1,400	1,300	1,000	1,100	1,500	1,700	1,500				
Miscellaneous (Armed forces, commercial, camp, trailer park, health spa, etc.	45,200	43,350	42,750	40,850	38,650	36,050	33,850	26,800	19,600	13,250	7,750	3,700	2,100	200
	1,850	6,600	1,900	2,200	2,600	2,200	3,950	3,700	2,450	3,500				
Residential (Built for private use by not more than two families and their guests)	1,328,600	1,242,200	1,163,500	1,097,100	1,021,500	934,800	851,300	713,900	575,700	455,200	340,100	171,100	87,500	2,500
	87,400	77,700	66,400	75,600	86,700	83,500	73,600	69,200	61,600	58,400				
TOTAL	1,708,600	1,614,600	1,530,400	1,453,300	1,361,800	1,257,100	1,155,300	982,900	804,200	645,900	489,900	254,200	133,000	10,800
	94,000	84,200	77,100	91,500	104,700	101,800	89,900	91,000	78,600	79,100				

*Bold Figures are Cumulative Totals Small Figures Are Pools Built During Preceding Year

Figure 1

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Number of Pools by Area

Totals Are Cumulative

	Jan. 1 1979	Jan. 1 1977	Jan. 1 1976	Jan. 1 1975	Jan. 1 1974	Jan. 1 1973	Jan. 1 1972	Jan. 1 1970	Jan. 1 1968	Jan. 1 1966	Jan. 1 1964	Jan. 1 1962	Jan. 1 1960	Jan. 1 1958
California and Hawaii	440,000*	414,200*	391,000	372,800	331,050	309,550	277,150	239,750	239,750	209,250	167,750	129,250	92,000	56,000
	25,800	23,200	18,200	20,000	21,750	21,500	17,100	17,200	15,900	19,500				
Northwest	35,670	33,450	32,050	30,850	29,600	27,750	25,950	23,650	21,350	19,450	17,250	14,050	10,400	6,400
	2,220	1,400	1,200	1,250	1,850	1,800	1,600	1,450	1,000	1,000				
Southwest and Mountain	219,985	200,350	183,550	169,450	153,800	137,050	122,150	100,150	80,550	61,750	42,950	26,250	15,600	5,900
	19,635	16,800	14,100	15,650	16,750	14,900	11,500	10,400	8,900	9,900				
Midwest	275,150	263,100	251,200	241,400	229,000	214,000	196,000	159,600	120,900	86,300	58,600	41,100	30,000	15,000
	12,050	11,900	9,800	12,400	15,000	18,000	18,700	19,800	17,200	14,700				
South	179,100	169,300	162,400	155,500	147,300	138,500	130,200	115,500	102,100	90,100	72,900	59,100	45,900	21,900
	9,800	6,900	6,900	8,200	8,800	8,300	7,600	7,400	5,500	9,400				
Florida	195,800	184,500	174,700	164,700	153,200	138,050	123,950	103,250	83,200	66,600	50,400	37,800	24,500	10,100
	11,300	9,800	10,000	11,500	15,150	14,100	10,700	10,500	8,700	8,200				
Northeast	362,895	349,700	335,500	318,600	296,100	270,700	247,500	203,600	156,350	112,450	80,050	55,450	35,800	17,700
	13,195	14,200	16,900	22,500	25,400	23,200	22,700	24,250	21,400	16,400				
TOTAL	1,708,600	1,614,600	1,530,400	1,453,300	1,361,800	1,257,100	1,155,300	982,900	804,200	645,900	489,900	363,000	254,200	133,000
	94,000	84,200	77,100	91,500	104,700	101,800	89,900	91,000	78,600	79,100				

Small Figures Are Pools Built During Preceding Year

Figure 2

Reprinted from 1978 Swimming Pool Industry Market Report with permission of SWIMMING POOL WEEKLY/SWIMMING POOL AGE

local requirements. This information should be obtained early in the design-program planning stage. If underwater lighting is to be used, it should be restricted to 12-volt lighting and should be equipped with ground-fault-interrupter equipment which has been checked for effectiveness by a qualified electrical engineer.

Underwater lights contribute greatly to the safety and maintenance of the pool and are essential to water show production. They add tremendously to the aesthetic aspects of the pool.

Attention to the spacing of underwater light units is needed. The Illuminating Engineering Society recommendations yield good results, although what appears to be needed is a calculation of lighting on the basis of volume, rather than the basis of area.

White lighting, containing a light tinge of blue, has been used successfully for night lighting. For outdoor pools that are lighted at night, amber lighting has proved most effective in minimizing insect attraction. Other colors reduce the transmission of light to a serious extent and cause the swimmers to look garish. Area lighting should be designed by a lighting specialist.

The N.C.A.A. recommends that indoor competitive pools be lighted with an intensity of 100 foot candles at the water surface, especially when events are to be televised. For recreation use, 60 foot candles is adequate. It is important to provide for easy and economical access to lights for changing bulbs.

Excessive source glare can be prevented by a sufficient number of fixture locations. Mounting height for fixtures should be at least 30 feet for uniform comfort levels and glare reduction.

Colored spotlights can be used effectively for architectural or aesthetic interest and for highlighting the diving tower, starting blocks, ladder locations, walls and other areas.

Infra-red heating lamps and quartzline heating fixtures, in addition to providing light, can be used effectively for projecting radiant heat to ensure extra comfort at principle activity locations. Springboard divers, during competition, must spend a considerable amount of time on the deck. Infra-red heating of the waiting area is desirable.

Control of Air Circulation

Air circulation and humidity control need close attention in pool design planning. Circulation fans should be removed from the pool area to reduce the noise level. Large volume air circulation designed to reduce humidity often results in chilling swimmers when they emerge from the water. Increasing the temperature of the circulated air makes the relative humidity even less and results in further chilling. It is essential to maintain a relative humidity of approximately 75 to 85% for swimmer comfort.

Whenever possible an "air-wall" should be maintained between swimming areas and spectator areas, and a lower temperature and humidity level should be maintained in the spectator area. Generally speaking, water temperature should be maintained at 79-84 degrees and the air temperature at deck level should be 4 degress warmer than the water. At temperatures above 85 degrees the air and water temperature should be the same.

Electrical Outlets

Multiple electrical outlets should be installed on the sides and ends of the natatorium wall. In addition, microphone jacks and possible underwater speaker jacks should be spaced according to program possibilities.

All electrical outlets should be of the weatherproof, outdoor type, grounded for safety.

Electrical outlets should be high enough above the deck to avoid water splash from mechanical deck scrubbers.

Deck Drains

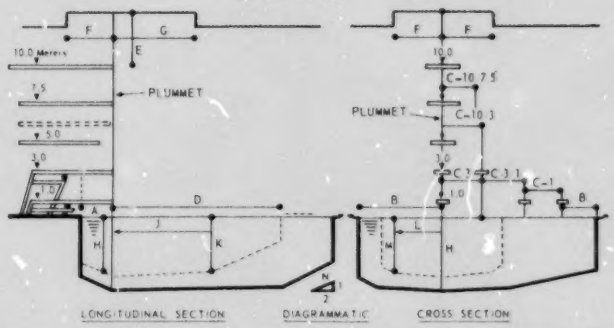
Consult local and state sanitary codes for placement of deck drains. In general, water splashed or carried from the pool should drain away from the pool lip to drains at the far edge of the pool deck. The slope toward the drains should exceed minimum requirements to ensure the absence of puddle formation on the deck.

Storage

A storage room should be accessible from the pool deck. This room should be constructed to meet the needs of the program and should relate to the specific facilities. It should be equipped with double doors and flush thresholds and should contain no obstructing pillars or inconvenient cul-de-sacs. A room with minimum dimensions of 20 by 40 feet will provide space to accommodate canoes, diving boards, rescue boards, water polo goals, SCUBA equipment and other large pieces of equipment used in the aquatic program.

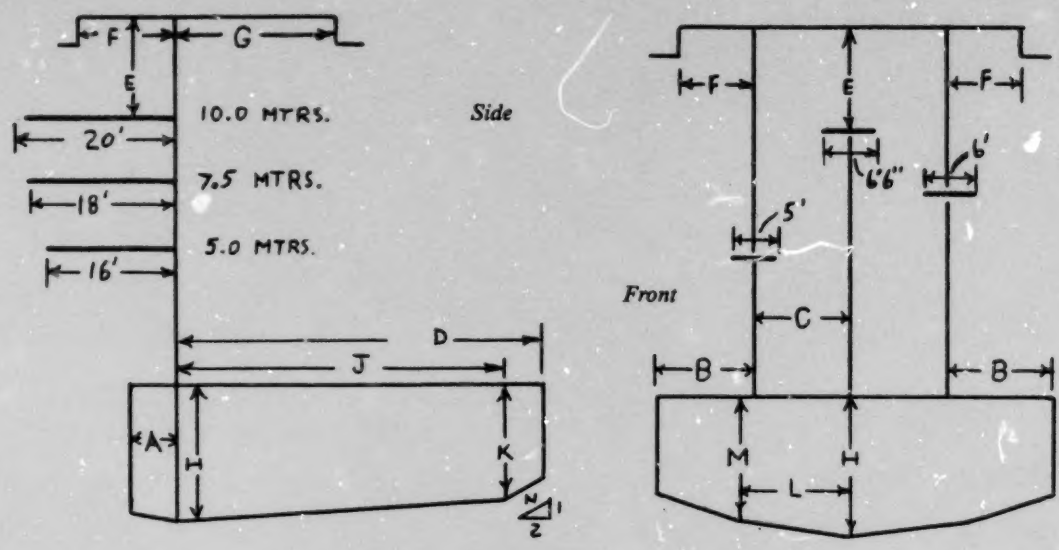
Ample storage space and easy access should be planned

Chart 4-A

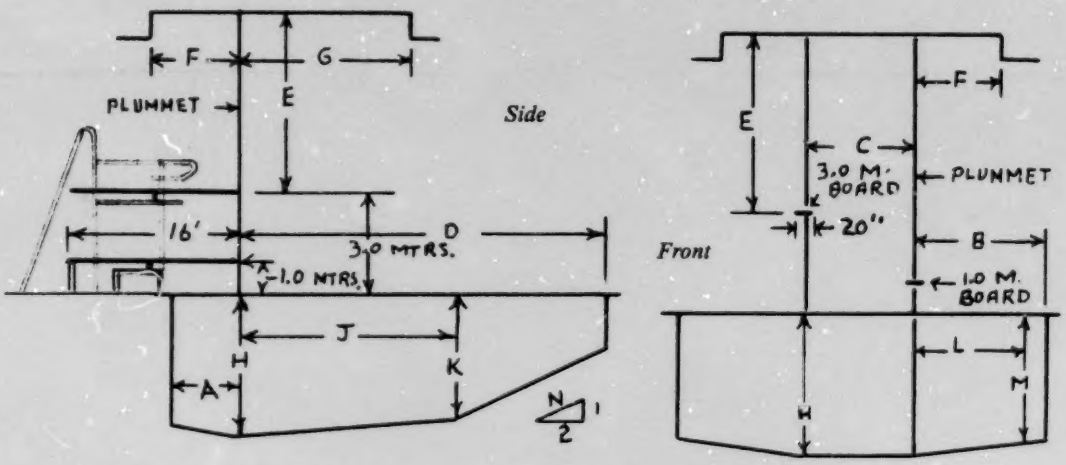


MINIMUM STANDARD DIVING FACILITY DIMENSIONS Adoption by NCAA in 1969		1-METER SPRINGB'D 16'x1'-8" (4.88m x 50.8cm)		3-METER SPRINGB'D 16'x1'-8" (4.88m x 50.8cm)		INTER-MED. PLATFORM 16'x5' (4.88m x 1.52m)		7½-METER PLATFORM 16'x 6' (5.49m x 1.83m)		10-METER PLATFORM 20'x6'6" (6.10m x 1.98m)	
		DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH
A	FROM PLUMMET BACK TO POOL WALL	6' (1.83m)		6' (1.83m)		5' (1.52m)		5' (1.52m)		6' (1.83m)	
	BACK TO PLATFORM DIRECTLY BELOW							5' (1.52m)		5' (1.52m)	
B	FROM PLUMMET TO POOL WALL AT SIDE	10' (3.05m)		12' (3.66m)		14' (4.27m)		15' (4.57m)		17' (5.18m)	
C	FROM PLUMMET TO ADJACENT PLUMMET	8' (2.44m)		8' (2.44m)	10' (3.05m)						12' (3.66m)
D	FROM PLUMMET TO POOL WALL AHEAD	29' (8.84m)		34' (10.36m)		34' (10.36m)		36' (10.97m)		45' (13.72m)	
E	ON PLUMMET FROM BOARD TO CEILING OVERHEAD	16' (4.88m)		16' (4.88m)		10' (3.05m)		10'6" (3.20m)		11' (3.35m)	
F E	CLEAR OVERHEAD BEHIND AND EACH SIDE OF PLUMMET	8' (2.44m)	16' (4.88m)	8' (2.44m)	16' (4.88m)	9' (2.74m)	12' (3.66m)	9' (2.74m)	12' (3.66m)	16' (4.88m)	12' (3.66m)
G	CLEAR OVERHEAD AHEAD OF PLUMMET	16' (4.88m)	16' (4.88m)	16' (4.88m)	16' (4.88m)	16' (4.88m)	12' (3.66m)	16' (4.88m)	12' (3.66m)	20' (6.10m)	12' (3.66m)
H	DEPTH OF WATER AT PLUMMET		12' (3.66m)		13' (3.96m)		14' (4.27m)		15' (4.57m)		17' (5.18m)
J-K	DISTANCE AND DEPTH OF WATER AHEAD OF PLUMMET	20' (6.10m)	10'9" (3.28m)	20' (6.10m)	11'9" (3.58m)	20' (6.10m)	11'9" (3.58m)	26' (7.92m)	13' (3.96m)	40' (12.19m)	14' (4.27m)
L-M	DISTANCE AND DEPTH OF WATER EACH SIDE OF PLUMMET	8' (2.44m)	12' (3.66m)	10' (3.05m)	11'9" (3.58m)	12' (3.66m)	11'9" (3.58m)	13' (3.96m)	11'9" (3.58m)	14' (4.27m)	14' (4.27m)
N	MAXIMUM RATIO VERTICAL TO HORIZONTAL OF SLOPE TO REDUCE DEPTH	1:2		1:2		1:2		1:2		1:2	

100



Minimum Dimensions for Diving Towers



Minimum Dimensions for 1 and 3 Meter Springboards
Figure 4

Refer to Chart 4-A

By D.G. Thomas

for storage of pool water chemicals, diatomite, and other materials required for operation of the pool.

Other Mechanical Installations

Below the aquatic wing, a tunnel should give easy access to all plumbing.

Filtration and chemical treatment equipment should be located as close to the pool main drain or pool outlet collection system as possible. Where a multiple pool complex is planned, the filtration equipment should be located between the pools, or at a central location to consolidate plumbing costs and to improve efficiency of pool operation.

Separate filter systems and temperature controls for each pool will greatly increase the flexibility in program and reduce the chance of a maintenance shutdown involving the entire complex.

CONSIDERATIONS SPECIFIC TO OUTDOOR POOLS

Location

Outdoor pools should be conveniently located in relation to other facilities for athletics, physical education and recreation. Locations in natural valleys, basins, or depressions in the terrain should be avoided. Relatively dry subsurface conditions are recommended. Locations adjacent to wooded areas, industrial plants, main traffic areas, or other sources of possible pool contamination should be avoided.

Design

The same design considerations are desirable for outdoor pools as for indoor pools, except that larger installations are frequently constructed outdoors.

Deck space for outdoor pools should be at least twice the

101

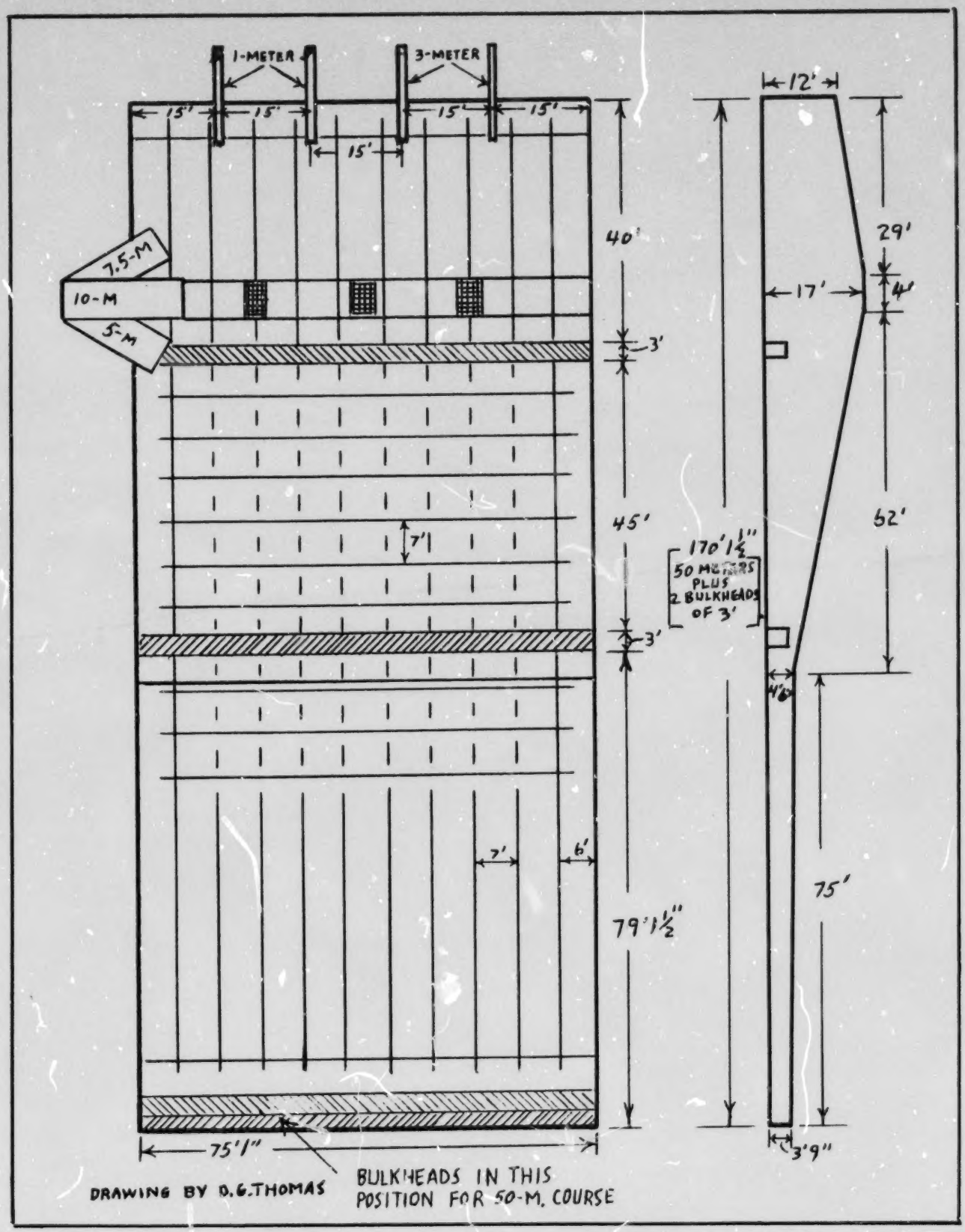


Figure 5

The 50 meter pool offers ample space for all aquatic programs. Two movable floating bulkheads make it very versatile. As shown, the bulkheads outline a standard 6-lane, 25-yard competitive course or water polo court.

square footage of the surface of the water. It is recommended that consideration be given to the development of a dry deck area for sunbathers.

Windbreaks

The structures housing the dressing facilities, showers, office, and mechanical equipment should be located to form a windbreak for the pool area in situations where the prevailing wind may interfere with swimmers' comfort. Plastic or canvas may be attached to the perimeter for additional windbreaks.

Water Heating

In temperate and colder climates, provision for heating the pool water will extend the annual period of pool use.

In very hot climates, it is helpful to provide for aeration or other cooling processes to maintain pleasant temperatures.

Pool Coating

The interior surface of the pool should be finished with a smooth coating that can be kept clean, but will provide traction for safe walking in shallow water.

Fencing

Outdoor pool installations must be completely enclosed by a fence at least seven feet high. Local and State codes should be consulted.

Diving Facilities

Diving facilities depend upon the type of outdoor installation. If at all feasible, the construction of a separate diving well is advocated. Boards and platforms should be mounted so the diver faces away from the sun during most of the day.

Diving platforms add to the flexibility of the facility, and their specifications should conform to official A.A.U. and/or Olympic requirements for competition. Appropriate rule books should be consulted for details.

Lanes

Competitive lanes for outdoor pools should be eight feet in width.

Entrances and Exits

Entrances and exits, and dressing rooms, should be located at the shallow end of the pool for safety, and ease of supervision.

Mechanical Equipment

Filters, pumps and other mechanical elements for the outdoor pool must have sufficient capacity to take care of the extra demands caused by airborne contamination elements, increased growth rate of algae, and the rapid dissipation of chlorine due to direct sunlight.

The Pool as Part of a Recreation Complex

In many cases, a community recreational swimming pool will be located in a park with other facilities. The relation of the pool to the other recreational facilities should be considered in order to make the most effective and economic use of the total park.

The pool complex should be designed with the total projected use in mind. The determining factors in its design are the number, ages, and special needs of the persons who will use the pool.

If the pool is to be used for competitive purposes, all requirements should be strictly followed with regard to distances, depth, markings, and special features.

Consideration should be given to swimming facilities for young children. Separate wading pools or increased shallow water areas in the regular pools may be considered. Areas of 3½ - 4½ foot depths can be increased to two-thirds of the pool length in larger pools. Separate wading pools of 6 - 30 inch depth should be provided for pre-school children. Such pools should be fenced and separately controlled for safety.

Because of the shallow depth and increased load of dirt and bacteria, all wading pools should have separate chlorinators and filter capable of two-hour turnover. Some state and local codes now require this additional filtration capability.

Spectator Seating

Bleacher-style spectator sections are needed when water shows and competitive meets are held in outdoor pools. Such seating may be permanent or portable, depending on the needs of each institution. The stands should be parallel to the length of the competitive course and be placed so spectators' backs will be to the afternoon sun.

Sound Systems

Public address systems, record players, and underwater speakers are desirable additions to outdoor installations.

In the design stage, conduits within the pool deck should be planned for hidden wiring for electronic timer mechanisms at each starting block, for public address and underwater loudspeakers, and for telephone communication with each lifeguard chair and the pool office.

A major consideration in designing the pool should be use of the facility by handicapped individuals. The locker room and pool areas should be accessible to and usable by persons with special limiting handicaps.

The number and placement of lifeguard stands and safety equipment should be made according to state and local regulations and the number of persons using a given area of the pool.

Provision must be made for checking clothes for safekeeping. A system of lockers, baskets or nylon checking bags are most commonly used. If the pool is to be used on a year-round basis, consideration must be given to the greater number of clothing articles which must be handled during winter months. See Chapter 9, for guidelines for locker room design.

An important aspect of the pool complex, both from a convenience and from a revenue standpoint, is the concession area. This facility must conform to all state and local health regulations and should be designed to serve the outside park area as well as pool patrons. Preferably, the concession area serving the inside pool patrons should be fenced from the pool deck area. No food or drinks should be allowed in the swimming area.

Adequate parking areas should be provided. In many cases, the same parking area can be used by various facilities within the complex. Planning should provide for easy access and orderly flow of traffic for the total complex.

Adequate provision for emergency and safety equipment should be made, and staff members should be trained in its use. A public address system is an essential element of the safety equipment as well as a convenience to staff and patrons.

103

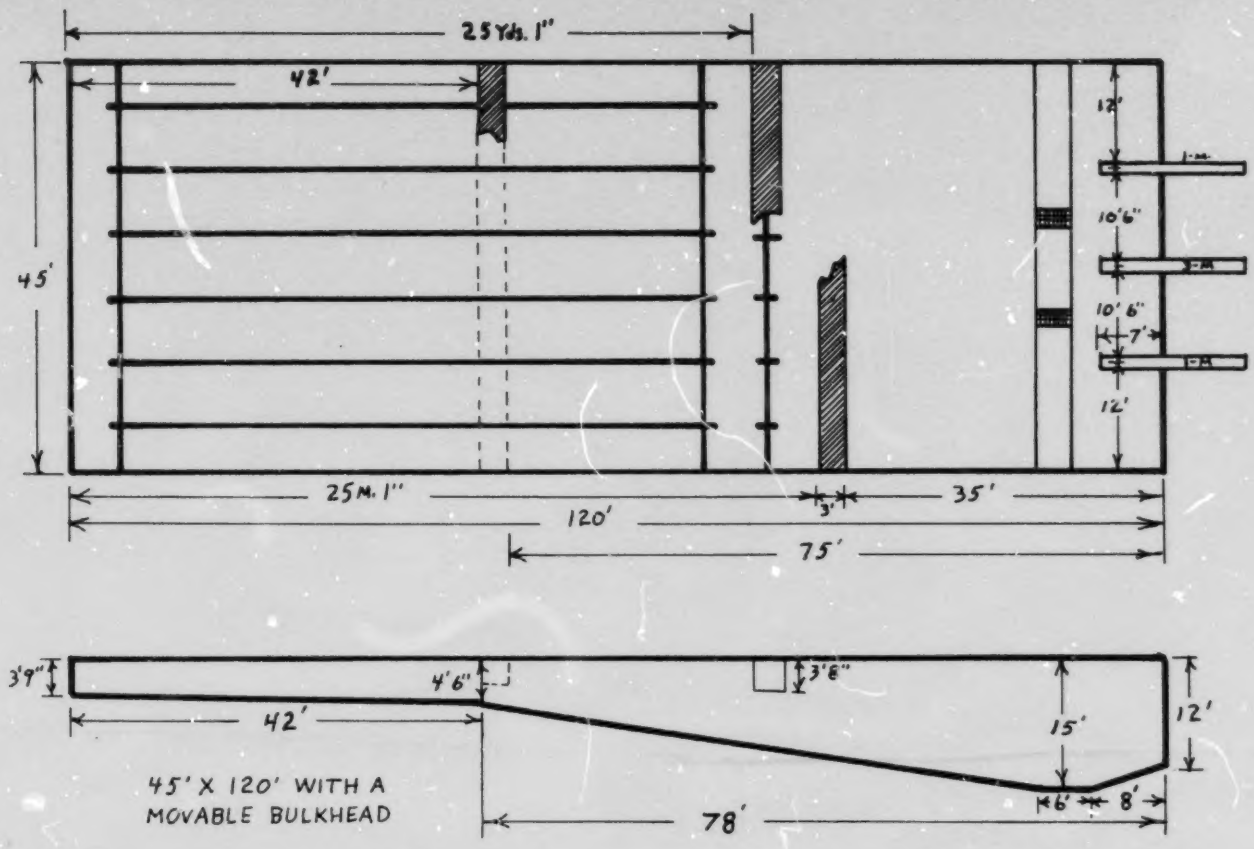


Figure 6

A practical pool for the institution unable to build a 50-meter pool. This pool, with easily movable bulkheads, provides adequate deep water area for lifesaving classes, water polo, SCUBA classes, springboard diving and synchronized swimming. It also solves the metric conversion problem.

CHECK LIST FOR PLANNERS OF SWIMMING POOLS

General Considerations

1. A clear-cut statement has been prepared on the nature and scope of the design program and the special requirements for space, equipment, and facilities dictated by the activities to be conducted. _____
2. The swimming pool has been planned to meet the total requirements of the program to be conducted as well as any special needs of the clientele to be served. _____
3. There are other recreational facilities nearby for the convenience and enjoyment of swimmers. _____
4. An experienced pool consultant, architect, or engineer has been called in to advise on design and equipment. _____
5. The design of the pool incorporates the most knowledge and best experience available regarding swimming pools. _____
6. The plan has been considered from the standpoint of handicapped persons (e.g., there is a gate adjacent to the turnstiles). _____
7. All plans and specifications have been checked and approved by the local board of health. _____
8. The pool is the proper depth to accommodate the various age groups and types of activities it is intended to serve. _____
9. The bathhouse is properly located, with entrance to the pool leading to the shallow end. _____
10. The locker rooms are large enough and have been considered from the standpoint of supervision. _____
11. The pool layout provides the most efficient control of swimmers from showers and locker rooms to the pool. Toilet facilities are provided for wet swimmers separate from the dry area. _____
12. Seating for swimmers is provided on the deck. _____
13. There is an area set aside for eating, apart from the pool deck. _____
14. The area for spectators has been separated from the pool area. _____
15. There is adequate deck space around the pool. More space has been provided than indicated by the minimum recommended deck/pool ratio. _____
16. The swimming instructor's office faces the pool. There is a window through which the instructor may view the entire pool area. There

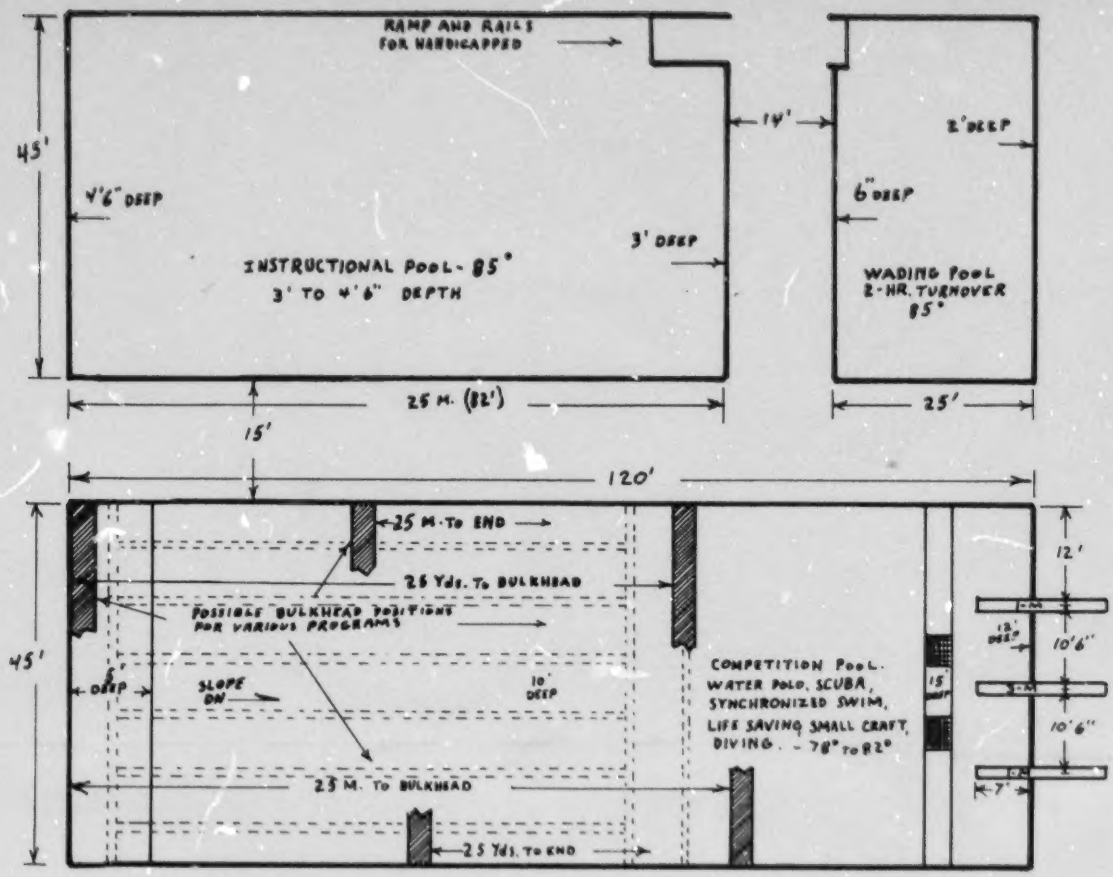
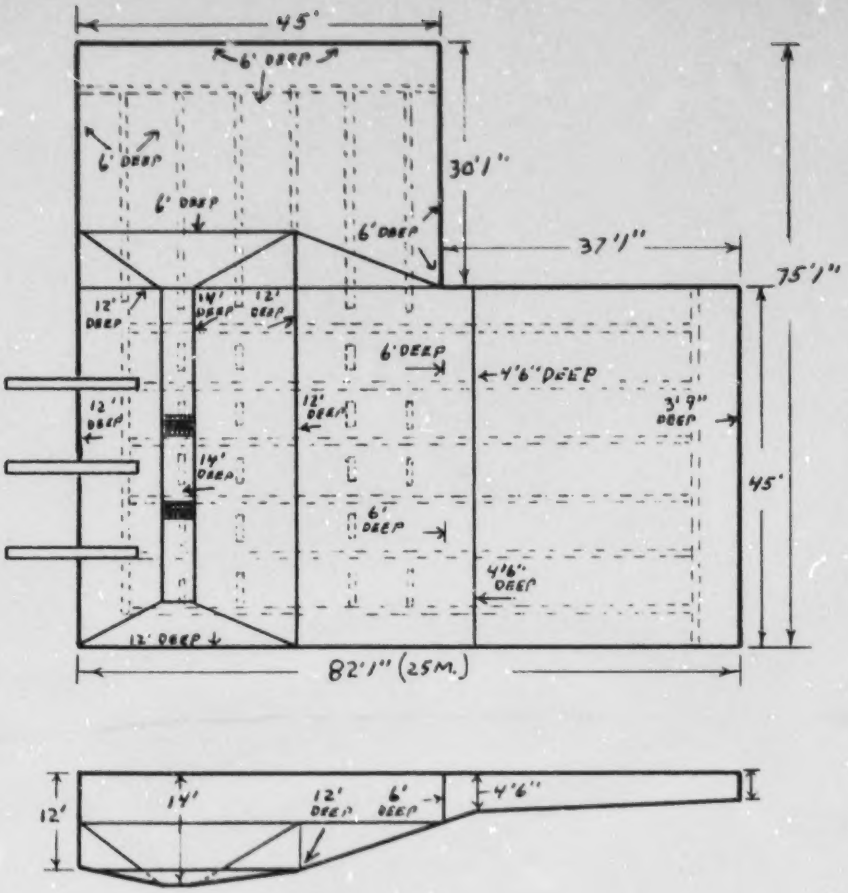


Figure 7

This 3-pool complex serves every aquatic need except a 50-meter Olympic event course. It serves more people and allows more concurrent classes than any single pool. Increasing the depth would make it suitable for platform diving.

is a toilet-shower-dressing area next to the office for instructors. _____

17. The specifications for competitive swimming have been met (7-foot lanes; 12-inch black lines on the bottom; pool one inch longer than official measurement; depth and distance markings). _____
18. If the pool shell contains a concrete finish, the length of the pool has been increased by three inches over the "official" size in order to permit eventual tiling of the basin without making the pool too short. _____
19. The width of the movable bulkhead has been considered in calculating total pool length. _____
20. Consideration has been given to the method of moving the bulkhead. _____
21. Provision has been made for the switch to metric distances. _____
22. There is adequate deep water for diving (minimum of 12 feet for one meter, 13 feet for 3-meter boards, and 17 feet for 10-meter towers). _____
23. Adequate space has been provided between diving boards and between the diving boards and sidewalls. _____
24. Recessed steps or removable ladders are located on the walls so as not to interfere with competitive swimming turns. _____
25. There is adequate provision for life-saving equipment and pool cleaning equipment. _____
26. All diving standards and lifeguard chairs have been properly anchored. _____
27. Lifeguard stands are provided and properly located. _____
28. Separate storage spaces have been allocated for maintenance and instructional equipment. _____
29. There is a coping around the edge of the pool. _____
30. The deck is of non-slip material. _____
31. All metal fittings are of non-corrosive material. _____
32. A properly constructed overflow gutter extends around the pool perimeter. _____
33. The gutter waste water has been valved to return to the filters and also for direct waste. _____
34. Where skimmers are used, they have been properly located so that they are not on walls where competitive swimming is to be conducted. _____
35. The proper pitch to drains has been allowed in the pool, on the pool deck, in the overflow gutter, and on the floor of shower and dressing rooms. _____
36. Inlets and outlets are adequate in number and located to ensure effective circulation of water in the pool. _____



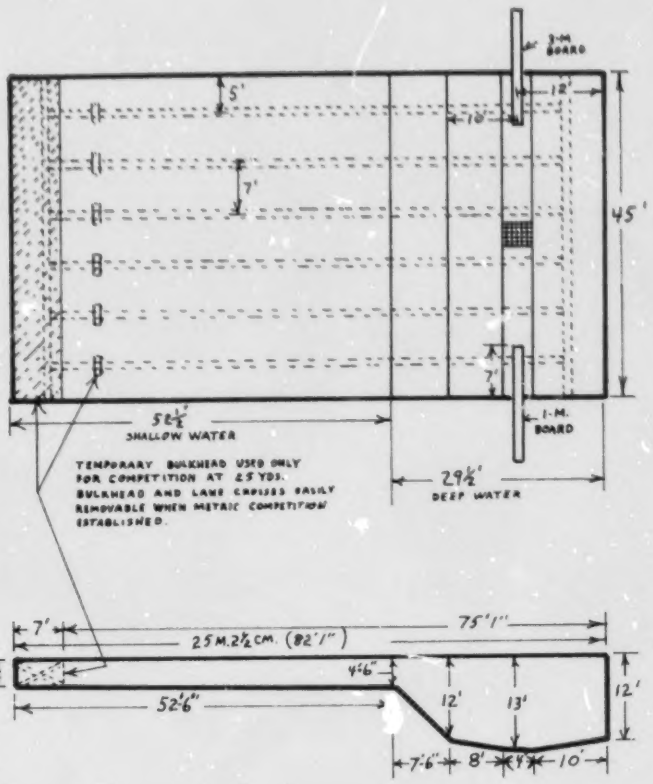
"L" Pool, 25 yds. x 25 M. 25 yds. x 45' area of deep water for polo, SCUBA, synchrc and life-saving

Figure 8

The L-shaped pool allows for competition in meters or yards and ample deep water for other programs. It does not allow as much shallow water for instruction, and is not as versatile as a 120 x 45 ft. pool with bulkhead. Nor can meet officials walk the full length of the course on both sides. If more shallow area is provided for instruction, it would not be suitable for water polo.

Figure 9

A smaller pool which is convertible from meters to yards by addition of a temporary bulkhead at the shallow end. Emphasis is on maxium possible shallow water for instruction while still allowing for safe springboard diving. It does not provide a sufficient length of deep water for life-saving classes or water polo and is poorly designed for synchronized swimming.



25m. x 45'
Minimum safe diving area.
1 M. and 3 M. boards. Only one board may be in use at any one time

37. There is easy vertical access to the filter room for both people and material (with stairway if required). _____
38. The recirculation pump is located below the water level. _____
39. The recirculation-filtration system has been designed to meet the anticipated future pool load. _____
40. Underwater lights are the 12-volt type, and all metal in the pool area is grounded to a ground-fault interrupter. _____
41. Consideration has been given to underwater lights, underwater observation windows, and underwater speakers. _____
42. Underwater lights in end racing walls have been located deep enough and directly below surface lane anchors, and they are on a separate circuit. _____
43. Access from deck to underwater windows is direct and uncomplicated. _____
44. There is a tunnel around the outside of the pool or a trench on the deck permitting ready access to pipes. _____
45. The gas chlorinator (if used) has been placed in a separate room accessible from and vented to the outside. _____
46. A pool heater has been considered in northern climates. _____
47. Automatic controls for water chemistry have been considered. _____

Indoor Pools

1. There is proper ventilation. _____
2. There is adequate acoustic treatment of walls and ceilings. _____
3. There is adequate overhead clearance for diving (16 feet above one and three meter boards, 11 feet above 10 meter platforms). _____
4. There is adequate lighting (60 to 100 foot candles at the water surface are recommended). _____
5. Reflection of light from the outside has been kept to the minimum by proper location of windows or skylights. (Windows on sidewalls are not desirable). _____
6. All wall bases are coved to facilitate cleaning. _____
7. There is provision for proper temperature control in the pool room for both water and air. _____
8. The humidity of the pool room can be controlled. _____
9. The wall and ceiling insulation are adequate to prevent "sweating." _____
10. An adjacent area is suitable for movies and lectures. _____

Outdoor Pools

1. The site for the pool is in the best possible location (away from railroad tracks, heavy industry, trees and dusty open fields). _____
2. Sand and grass have been kept the proper distance away from the pool to prevent them from being transmitted to the pool. _____
3. A fence has been placed around the pool to assure safety when not in use. _____
4. Proper subsurface drainage has been provided. _____
5. There is adequate deck surface for sunbathing. _____
6. The outdoor lights are placed far enough from the pool to prevent insects from dropping into the pool. _____
7. Diving boards or platforms face north or east. _____
8. Adequate parking space has been provided and properly located. _____
9. The pool is oriented correctly in relation to the sun. _____
10. Wind shields have been provided in situations where heavy winds prevail. _____

(See Appendix for portfolio of pool photographs)

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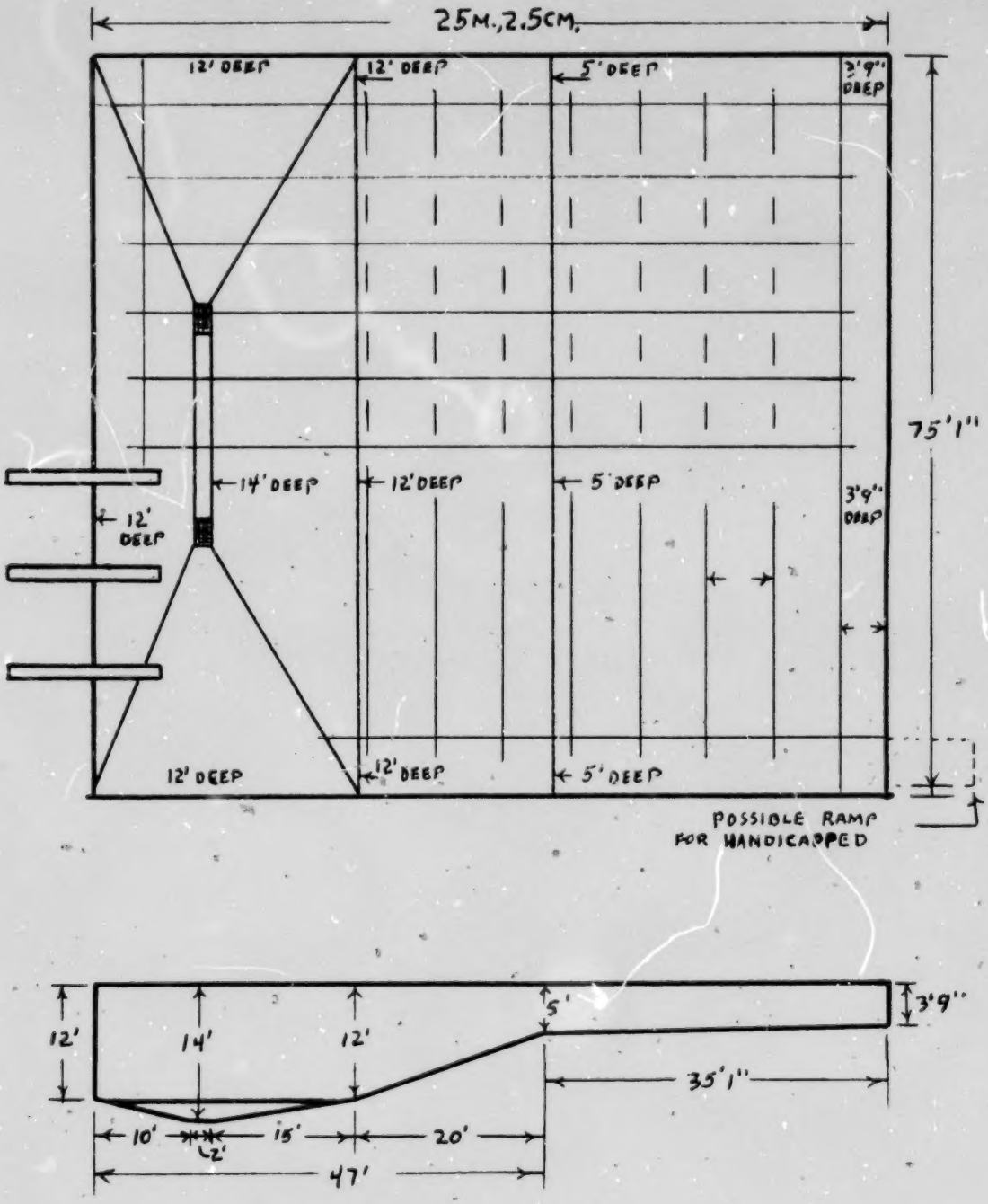


Figure 10

Adequate space for all programs is provided in this pool, but meet officials are limited to one side of the course. Anchors for backstroke pennant lines must be installed on the pool bottom, or must span an extreme distance. The pool is rather inconvenient to divide into areas for water sports or teaching.

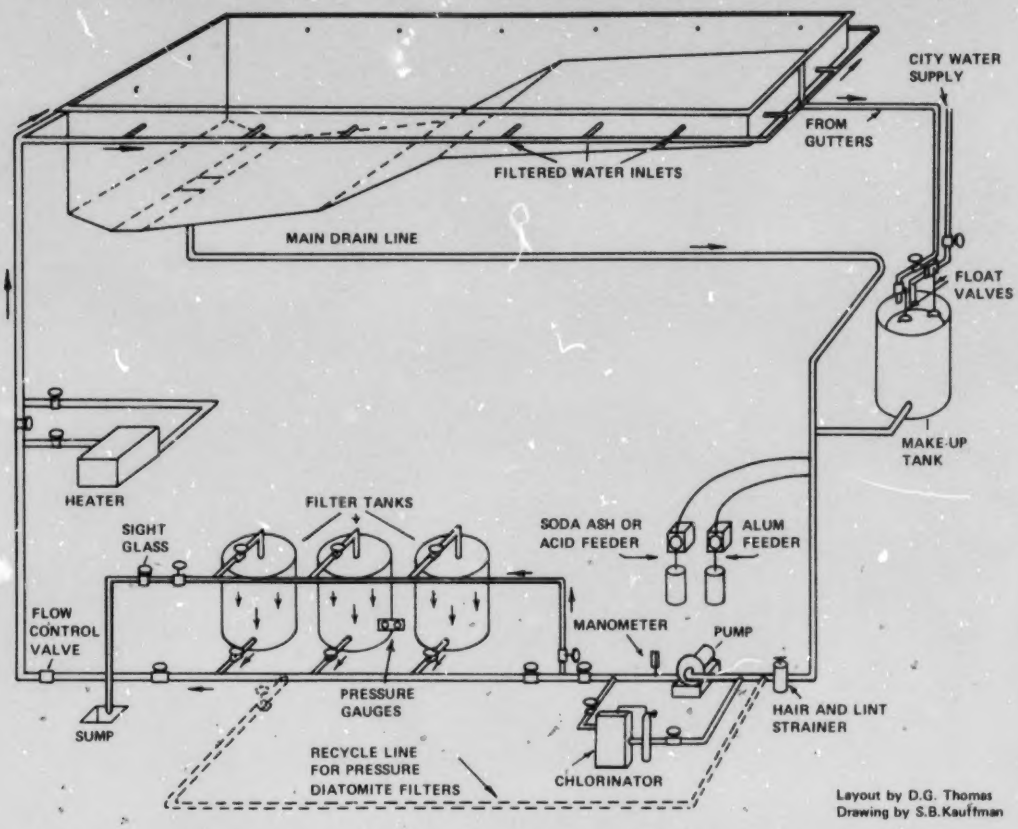


Figure 12

RAPID FLOW SAND AND GRAVEL, HIGH RATE SAND, OR PRESSURE DIATOMACEOUS EARTH FILTER SYSTEM

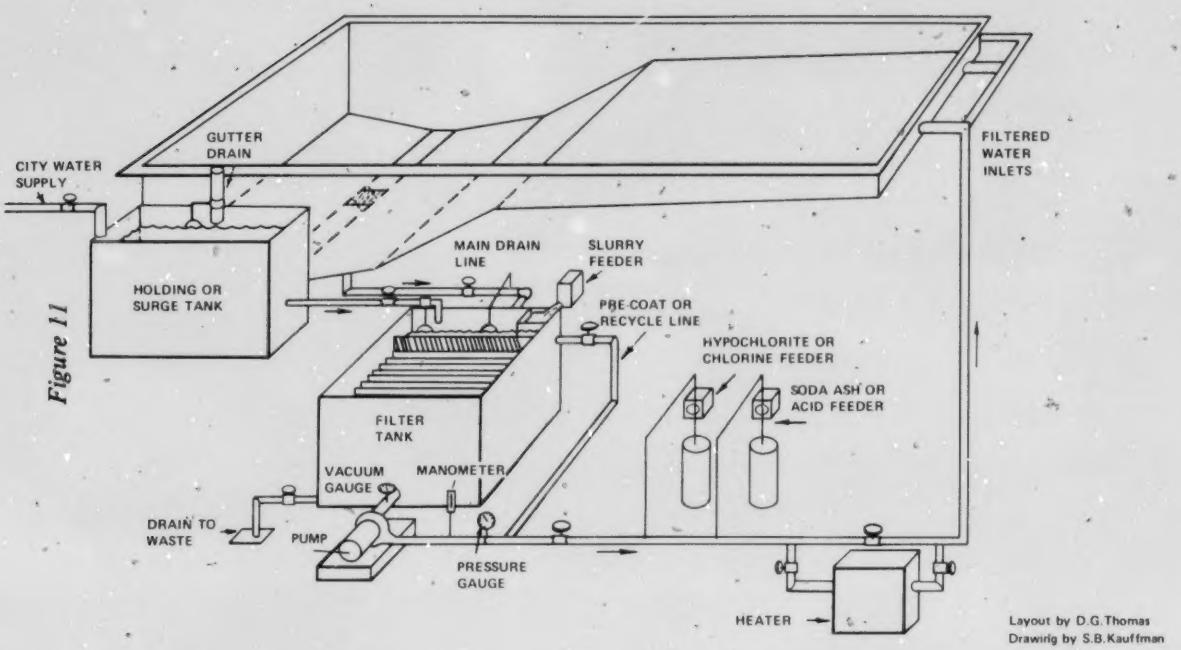
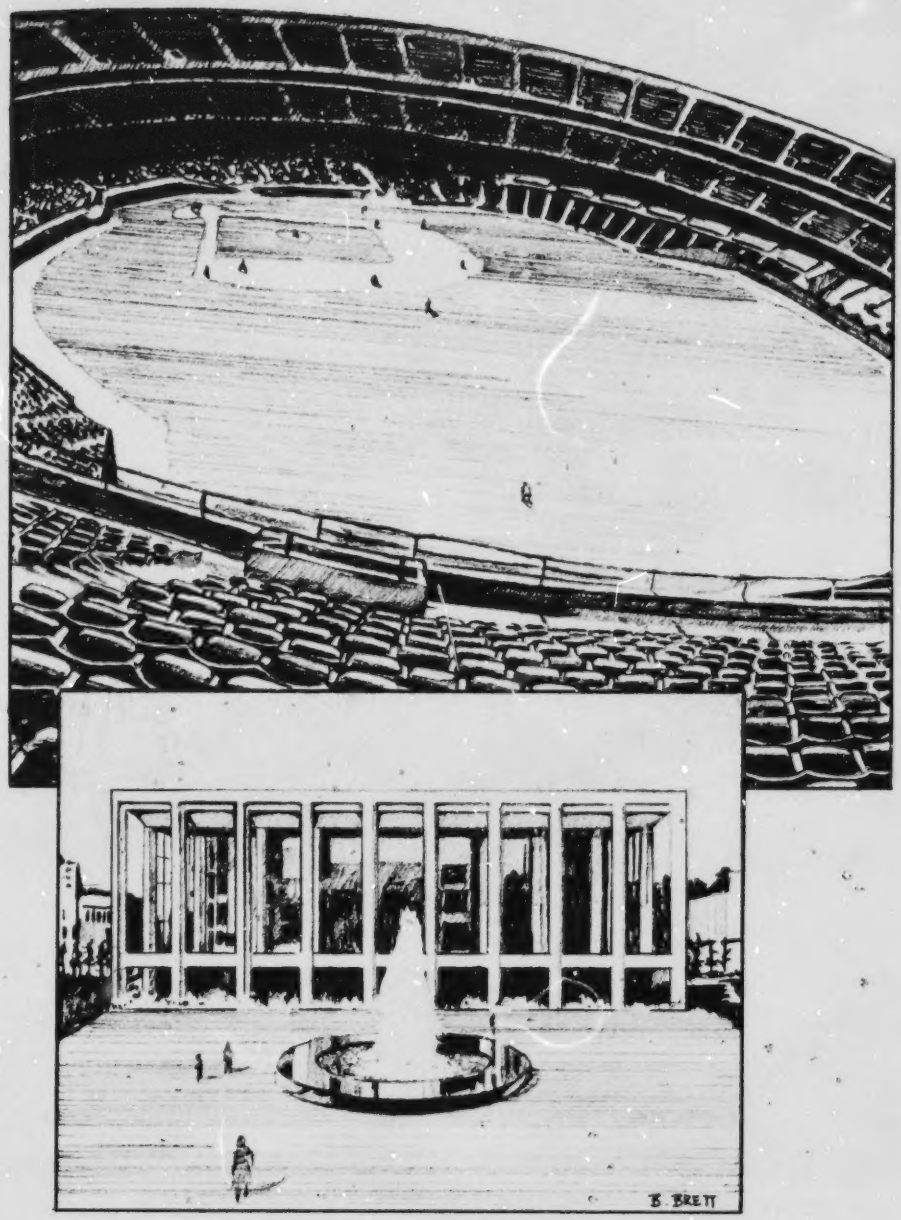


Figure 11

VACUUM DIATOMACEOUS EARTH FILTER SYSTEM



V.
Encapsulated Spaces and Stadiums

Encapsulated Spaces and Stadiums

TODAY, THE TREND is toward the multipurpose center serving a wider range of needs than those of the traditional athletic and physical education programs. New synthetic materials, new building techniques, and, most importantly, new program needs appear continually, making the task of building a permanent, single-use edifice nearly impossible and surely unwise.

The term "encapsulated space" by definition refers to surrounded, encased, or protected space. In common usage, the term has come to refer to any sport building or relatively large enclosed space, including fieldhouses, domed stadiums, natatoriums, ice rinks, arenas, tennis centers, auditoriums, and warehouses. This chapter will be limited primarily to analysis of the fieldhouse and stadium, with a brief review of the physical education center (under the heading, "Conventional Design").

Fieldhouses were first constructed in the United States to meet storage needs near outdoor sports fields. In the early season or inclement weather, it was a natural step to move practice periods for outdoor sports under the roof and on the dirt floors of the fieldhouse. As the structures became more sophisticated, dirt floors became unacceptable, and flooring surfaces were added which included wood, asphalt, urethane, and artificial turfs. Designers began to include locker and team rooms, full plumbing facilities, offices, and spectator accommodations providing wider indoor recreational and instructional usage.

Stadiums are built more specifically for exhibition purposes with mass seating. In addition to competitive athletic events, these structures are often used for such purposes as convocations, concerts, mass meetings and rallies. If located near educational facilities, they are also used for instructional purposes.

General Planning Considerations

To insure that the facility will meet the intended needs of users, whether students, faculty, citizens, or professionals, preliminary study should include a survey of existing facilities and resources; present and projected physical education, athletic, club or recreational programs; maintenance requirements; tournament and mass meeting requirements; and landscaping and parking needs. Ultimately, architectural design should take into account the survey findings as well as general terrain, regional building styles, practicality, diverse materials, and aesthetics.

The plans and specifications must conform both to state and local regulations and to accepted standards and practices. The building committee must understand its role: to coordinate, approve, recommend, support, challenge, advocate and deny. It is a task with many ramifications. When an institution has determined that more space is needed for current programs or more income is needed, exploratory meetings are essential for determining what to build and how to build it. Remember that the technology is available to build whatever can be envisioned, and, in the early stages, all ideas are valuable.

Location

The location of the new facility is of prime importance. Such a decision must take into consideration accessibility, drainage, aesthetics, landscape and topography, property lines and easements, utilities, ecological and biological conditions, parking, and security.

The facility should be accessible to those who use it most frequently. Therefore, it usually should be located near dormitories and physical education buildings. The facilities open to spectators should be easily accessible to the public and, at the same time, separated from other building. An analysis of the anticipated traffic flow in the building will pay enormous dividends in terms of efficient supervision and lower maintenance costs.

Facilities should be located to permit expansion. Attention should also be given to the slope of the land outside the buildings to assure surface drainage. Engineering features for

foundations, reinforcement, drainage, pumps, and valves should be carefully assessed.

The facility should be located in attractive surroundings and should be pleasing in design. The design should be functional rather than traditional. It is possible for an architect to plan a building that will be modern and functional but still blend in with the existing architecture of an area. An effort should be made to locate the structure away from industrial and congested areas.

Adequate parking areas adjacent to the facility, with a paved access roadway leading to the building, are necessary. When admission is charged for parking, a fence with a minimum height of seven feet surrounding the spectator structure and the enclosed field is essential. Gates are necessary for spectator and service entrances and exits. Admission gates should be located near the parking lots and other main approaches to the structure. The number and size of the entrances depends on the projected and potential attendance. Exits should permit the crowd to vacate the enclosure in 10 minutes. Twenty-two inches of linear exit space should be permitted for each 500 spectators. At least one gate 14 feet high and 14 feet wide should be provided to accommodate trucks and buses.

Fieldhouses

Today, the building most commonly known as the "fieldhouse" is a structure that encloses a large sports area for physical activities that do not warrant an expensive, monumental school structure. Instead, the activity area is enclosed by low-cost construction. The structure, a competitive necessity in cold weather climates, is common in the northern lattitudes.

Time and acceptance of low-cost construction has made it difficult to differentiate between the gymnasiums built in recent years and the fieldhouse of earlier decades. Historically, the gymnasium was a small enclosed area for indoor sports surrounded by the main school structure. Today it is a large expanse located in a wing of the building or in a separate building. In many cases, the gymnasium and fieldhouse have become synonymous.

Typical education functions performed in the fieldhouse include instruction in the physical education program; practice for intercollegiate athletics; intramural, interscholastic or intercollegiate competition; informal play; horseback riding; exhibitions; commencement exercises; registration; and final examinations. Community uses may include concerts, exhibits and mass meetings.

Educational institutions should consider total activity program needs when planning a fieldhouse. It is desirable to include facilities for women's physical education and recreation, such as tennis, volleyball, badminton, and golf.

Location and Size

Some institutions may wish to plan a fieldhouse in connection with a stadium or arena. In this case, consideration should be given to combining the two structures in such a manner that the back wall of the stadium may serve as one of the sidewalls of the fieldhouse. Such a plan may have interesting possibilities, both from the standpoint of economy and effective development of the areas under the stadium.

If the fieldhouse is needed for class instruction on a campus, the preferable location is adjacent to the main gymnasium building and natatorium. If space is not available in proximity to the gymnasium, the fieldhouse will effectively service the intramural activities and intercollegiate sports, even though it is constructed in a peripheral area of the campus. It should, however, be placed in an area contiguous to athletic fields and free from critical parking problems.

A recent innovation on some large university campuses are "satellite" fieldhouses, developed at several locations on campus contiguous to the dormitories or living quarters. This makes recreational areas immediately available to the students and eliminates the need for locker room facilities at the site. Locating facilities "where the students are" promotes recreational participation and reduces parking problems at the central area facility (Figure 1, 2).

The size of the fieldhouse should be determined by careful study of the present and future needs of programs in athletics, physical education, and recreation; climatic conditions of the area; existing facilities; and available funds. Consideration should be given to the size and make-up of the population likely to use the facility simultaneously.

The minimum length of the fieldhouse should accommodate at least a 60-meter straightaway for track, plus sufficient distance for starting and stopping. A wide door at the end of the straightaway, to permit competitors to run outside the fieldhouse, will prevent injuries and eliminate a psychological hazard where space is limited. Six lanes are desirable. Field level entrances for the public should be sharply limited in order to prevent collisions between runners and other individuals. The track size should be compatible with the demands of competitive running events.

The area surrounded by a one-eighth meter track can include the following facilities: a regulation basketball court (or several basketball cross-courts), tennis courts, broad-jump, high-jump and pole-vault runways and pits, and a shot-put area. It is preferable to isolate the shot-put area at one end of the building. Portable pit boxes can be brought within the track oval for shot-put, high-jumping and pole-vaulting during meets attracting spectators. The minimum width required to house a baseball infield is 125 feet.

Thus, the size of the facility depends in large part of the kinds of activities it will house and the number of participants. Dimensions of the activity area should not be less than 150 by 250 feet. The practical number of square feet per person is determined on a sliding scale. Under normal circumstances, a college of 1,000 students requires 18 to 20 square feet per student, while for a larger institution the figure decreases to 12 to 15 square feet per student.

The height of the structure will be determined by the number and location of the balconies to be provided. The fieldhouse must be able to accommodate crowds effectively and safely, particularly when many different types of activities are scheduled.

Fieldhouse Encapsulation

The encapsulation of vast surface areas to accommodate multipurpose field layouts has created the opportunity to develop a variety of construction techniques. Tensile structures, systems engineered buildings with modular capabilities, wood Quonset structures, geodesic domes, and air-supported membranes are examples of building designs that have been successfully used in fieldhouse development.

Systems Construction

The term "systems construction" commonly refers to buildings consisting of pre-designed, pre-engineered, factory-

Figure 1
Exterior and interior views of satellite recreation building at Ohio State University

constructed units shipped to the site for installation. The layman usually refers to these buildings as prefabricated or modular buildings. These buildings offer a wide range of possibilities for exterior and interior design. Systems building was introduced in the United States in 1962, and, interestingly enough, schools were major clients. The one-level sprawling schools that dot so much of the American landscape are testimony to the systems approach. More sophisticated designs and technology now enable facilities to be built in this fashion while escaping this sameness of appearance.

The prolonged construction time of many projects renders buildings obsolete the day they are completed. A viable school building program, therefore, depends in large measure on effecting economies in both time and money. Systems construction has managed to control the length of building time and subsequently the cost of construction.

Ideally, systems building comprises four stages:

1. Study of user requirements.
2. Establishment of performance standards for the building subsystems or the entire system.
3. Integration of individual building subsystems into a coordinated building system.
4. Testing of components (or subsystems) to assure that they satisfy performance standards.

One begins, always, by describing the way in which a facility must work. Then portions of the project are isolated for open, competitive bidding, creating a series of solutions, or subsystems. It is a condition of each solution that it must integrate with all the others, a requirement that fosters cooperative efforts on the part of many subcontractors.

Construction systems are erected quickly, enabling inside work to proceed uninterrupted by unfavorable weather. Site construction depends on a builder's ability to apply the modular systems to a particular type of structure. The full value in systems construction depends on the builder's performance in fitting the pieces together.

One advantage of systems building is "fast track scheduling." This technique saves time and thereby reduces construction monies. The system permits several construction steps that normally follow one another to proceed simultaneously, resulting in significant time savings. The theory behind fast tracking holds that any phase of a project can be begun on a foundation of generalized knowledge. The specific needs can be determined at a later date without sacrificing efficiency in either the design or construction processes. The necessary beginning drawings for the systems portion of the project can be issued as soon as basic-design decisions are reached. This enables the architect to apply fast track scheduling. Consequently, those parts of the building which require the most time, such as foundations may be begun immediately.

Figure 2
University of Michigan North Campus Recreation Building

Figure 3
Hyperbolic paraboloid design: Branch Rickey Center at Ohio Wesleyan

Figure 4
Systems engineered modular natatorium at Worthington (Ohio) High School

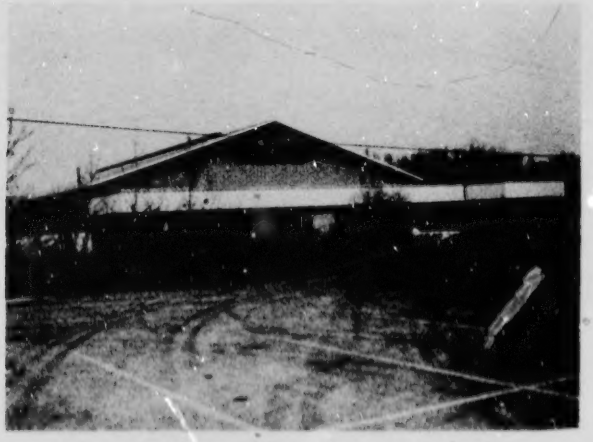


Figure 4-A
A modular steel building which covers the Iceland ice arena

The modular concept is employed in the construction of the popular fieldhouse/arena activities center with the hyperbolic paraboloid architectural style. Any number of modules are developed, and the activities spaces are placed inside the building. Additional modules can be added as needed at a future date (See Figures 3, 4).

Tensile Structures

Tensile structures are a viable alternative when climatic conditions or building codes prevent the use of the air structure. Tensile structure incorporates a membrane cover supported by rigid columns. Cables are carried to anchor points and over poles or masts for support and stabilization. Lightweight structures do not require the same amount of construction materials needed in conventional buildings. Fabrics manufactured by several corporations are like those used on the air structure with cable-restraining nets. They are noncombustible, self-cleaning, and maintenance free. The tensile structure, unlike the pneumatic structure, can be partially opened when desired without affecting the structure of the building. The concept is the same as if the sides of a tent were rolled up (See Figures 5,6,7,).

Geodesic Dome

A geodesic dome offers another option in encapsulation. Basically, a geodesic dome is a "framework to enclose space." In this context it is encapsulating space. In technical language a geodesic dome is the result of a series of physical and complex mathematical properties that create a lightweight, strong, transportable and economical structure that can be used in a multitude of ways. It is made by precisely interlocking triangles which appear as a series of hexagons on a completed building. Enormous spans and heights can be achieved, including a complete sphere, without the need of inside support walls. The familiar half-sphere shape has given way to many complicated shapes as engineering knowledge and confidence has progressed.

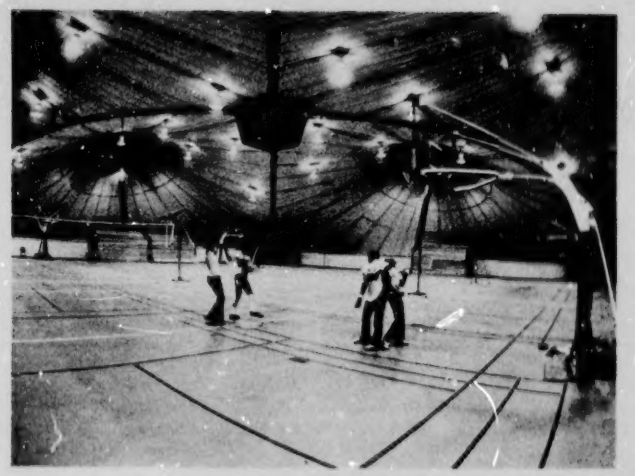
Air Structures

Traditional roofs constructed of wood and/or steel have, since about 1961, been joined by a newly accepted type of roofing—air structures. Air shelters work well as environmental covers placed over existing recreational areas, and for many institutions, the "bubble" is the answer to an increasing need for large activity areas at a nominal cost. Cost savings are in proportion to the size of the space to be covered. Spaces over 300 square feet usually bring a cost savings when compared to conventional roofing. Because of heat gain, which seems to present a more severe problem than heat loss, the northern areas of the United States seem to be better suited for environmental covers. There are numerous playing fields around schools and colleges which lend themselves easily to air fabric encapsulation.

There are a number of different kinds of air structures now on the market, consequently air shelter technology has become more sophisticated. *Canadian Architecture* listed the following advantages and disadvantages of air shelter technology:

Advantages

- *Low initial cost.* Air shelters allow a client with a small capital budget to acquire a facility that could not be obtained if conventional construction techniques were employed.



Figures 5 and 6
Interior and exterior views of La Verne College Student Center and Drama Center

• *Speed of erection.* The actual erection of the envelope takes only one or two days. However, additional time is required for the ground work, site services, foundation, anchorage, flooring, and installation of mechanical and electrical equipment. Only minimal field labor is needed.

• *Ease of deflation, inflation, and repair.* Deflation and inflation of the fabric envelope does not require skilled labor. Many existing structures come supplied with repair kits. (The repair of a major fault requires skill and special equipment such as that needed for electronic fabric welding.)

• *Portability.* When deflated and packed, the fabric envelope can be stored in a small space or easily transported elsewhere for storage or use. Depending on the size of the envelope, deflation and packing requires one or two days.

• *Adaptability for temporary functions.* For temporary use, the air-supported structure has definite physical and financial advantages over a conventional building. A number of manufacturers are now preparing to lease their air-supported structures, which will increase their attractiveness for short-term use.

• *Long-span and high-ceiling features.* Clear and unobstructed space is an inherent feature of the structure. Conventional long-span and high-ceiling structures are much more expensive. When the intended function demands these structure attributes, the air-supported structure may have a definite economic advantage.

• *Integrated heating, ventilation, and air-pressure system.* The integrated system is also an inherent principle. Lengthy duct works and pipe works are not required. The warm-up time of the space is a matter of minutes.

• *Maximum use of daylight illumination.* Translucency is characteristic of some kinds of envelope fabrics. Artificial lighting is minimized during daytime use.

Disadvantages

• *Limited portability in certain applications.* The degree of portability depends on the type of construction (concrete foundations, conventional flooring such as wood), and site services such as gas and electricity are not portable.

• *Life span.* The fabric envelope in use today has a life expectancy of up to 25 years, with longer-life materials being tested. All other items such as the foundation, flooring, and mechanical equipment have the life span of a conventional building.

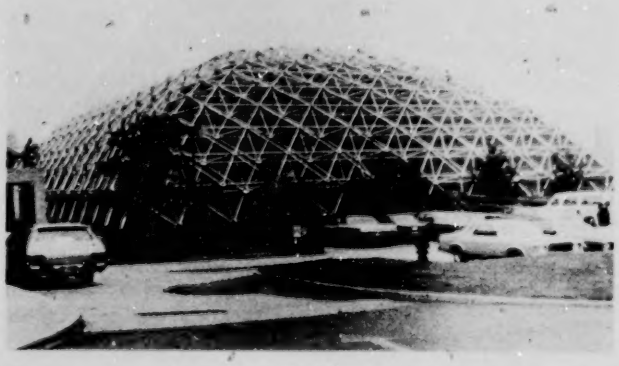
• *Poor thermal insulation.* The cost of heating is a significant factor and should be evaluated against that for a conventional building over time. During winter months when the heat is required to melt the snow or to cause it to slide off, a safe level of temperature will have to be maintained at all times at the expense of heating costs. If the bubble is not to be heated during the inactive hours, it will have to be supervised constantly for the dangers of unexpected snowfall. In the summertime the heat gain of the air-supported structure poses a cooling problem.

• *Acoustic problem.* The curved shape of the air-supported structure produces a peculiar acoustic environment. This poses limitations on its use for large gatherings and open-plan arrangements for different groups.

• *Pressure.* Although the air pressure in the structure is only one inch of water column, some sensitive people feel a slight effect on their eardrums, particularly at the moment of entering the structure.

• *Uncertain performance over a long-term period.* Although the structure has undergone numerous tests by recognized laboratories, many long-term predictions are extrapolated from short-time tests. Some regard this kind of "accel-

Figure 7
Supported membrane construction for fieldhouse at Cleveland State University



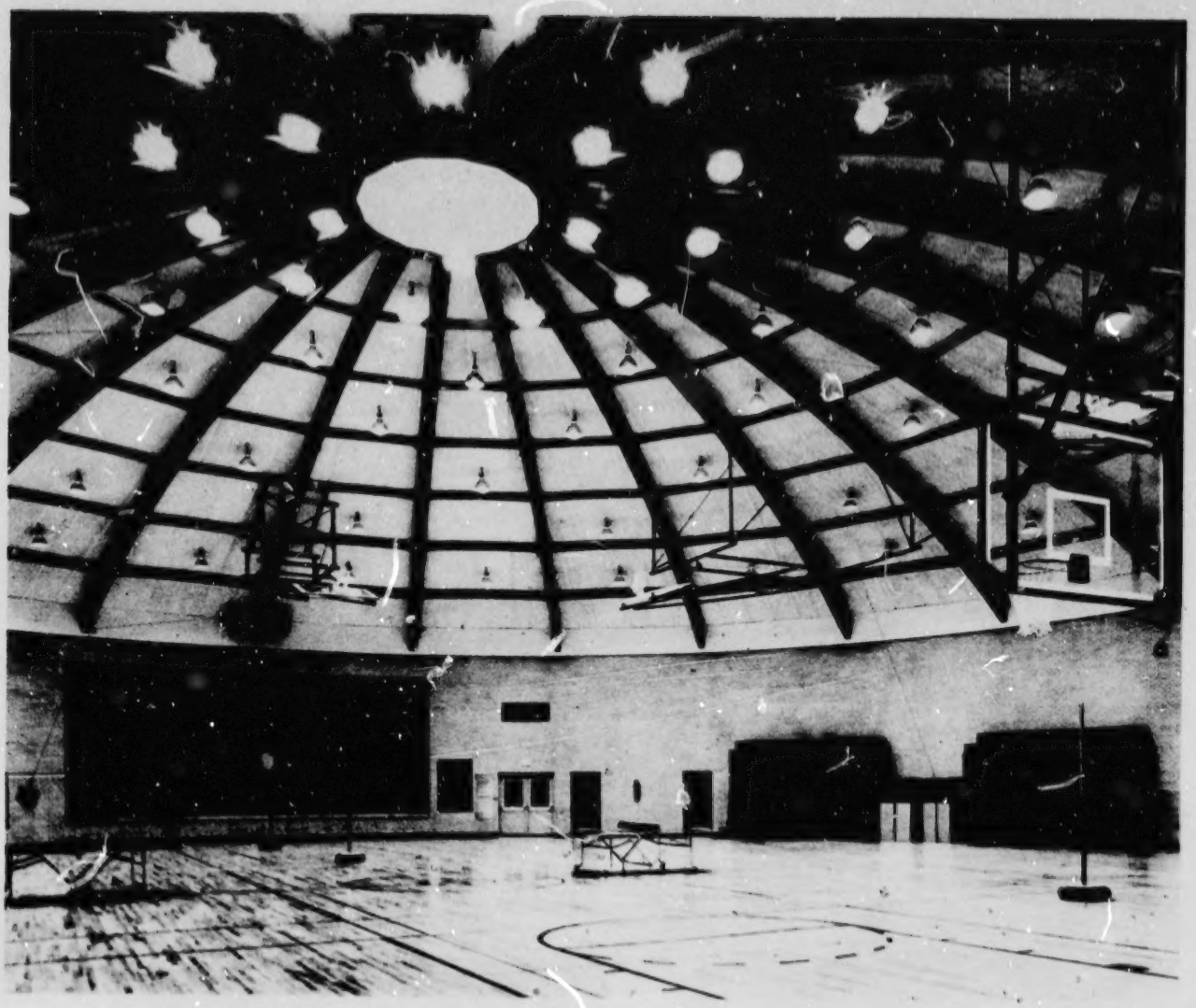


Figure 7-A

The dome roof over the gymnasium area at the new Central High School in Natchidoches, La., incorporates 24 laminated wood arches, 60 feet long, with stabilizing laminated wood ribs and purlins.

Figures 8 and 9

The triple geodesic dome (left) at Elmira (N. Y.) College and (right) the domed roof concept at Oterbein College in Westerville, Ohio.

erated test" as of little use, whereas others place great faith in it. Because of the short history of this type of structure, it is not yet possible to demonstrate performance value over time.

- *Restriction due to wind.* In winds of hurricane velocity, most codes require that the structure be evacuated.

The true capabilities of encapsulated space have barely been uncovered. With today's advanced technology, and with creative minds in the architecture, engineering and physical education professions, future facilities for sports can reasonable be expected to be technically sound, programmatically utilitarian and aesthetically pleasing.

Conventional Design

Although building to encompass large areas in the fieldhouse concept will satisfy many of the activities which meet the needs of individuals, there is still the necessity to house other teaching areas in smaller sectors or isolated teaching stations. Thus, the conventional design still remains popular when program needs dictate.

The architectural style is generally designed to conform with the municipal or campus surroundings. Function, rather than appearance, should determine the building style ultimately accepted.

Many of the larger complexes have been built to incorporate the fieldhouse as a segment of the total building.

Fieldhouse Floors

The floor of the fieldhouse should be resistant to weather and heavy usage. Dirt floors are not recommended. Rubber asphalt, urethane, and poly vinyl chloride synthetics are most commonly used in multipurpose areas. Wood, still a popular flooring, is frequently used in combination with synthetics when basketball and volleyball are located in the fieldhouse.

Lighting, Heating and Ventilation

Windows should be located to prevent the interference of sunlight with player performance at any time during the day. This is particularly important when baseball is played. Walls and ceilings should be light in color. Catwalks are necessary for servicing the ceiling lights, spotlights and drop nets for partitioning.

Condensation problems should be given major consideration, particularly where extreme temperatures require sprinkling of surface or dirt areas, or when large crowds witness events in the fieldhouse. To promote reabsorption of excess condensation, the building should be heated by the circulation of warm air in addition to radiant heat. Adequate means should be provided to supply and exhaust air. The walls inside and outside should be impervious to vapor pressure. Technical heating, ventilating, and lighting problems should be referred to a specialist. In the typical fieldhouse, which includes a tunnel vault roof, there should be no parapets.

Bleachers and Balconies

Permanent seating facilities may be provided in a balcony and on the level of the playing floor. Because permanent seats restrict the use of a floor space, they should not be used at the level of the playing floor in such a facility.

The height of the last row of seats is determined by the number of rows and the increased elevation of each. The height of the seating surface of the first row should be 22 inches from the floor, and each successive row should be 8.5 to 11.5 inches higher than the preceding one.

The width of each seating space should not be less than 18 inches. The required space per person will vary from 2.7 to 3 square feet. Sight lines should be considered in relation to the increase in elevation between successive rows. Spectators should have focal points of vision at the court boundary line nearest the seats. Focal points more than three feet above those boundary lines are unsatisfactory (See Figure 16).

When bleachers are extended, the first row should be at least 10 feet away from the court sidelines and end lines. The depth of closed bleacher varies from 3 feet for 10 rows to 4.5 to 7.5 feet for 23 rows.

The elevated seating deck or platform can be used to supplement the number of seats provided at floor level. Removable bleachers for the deck should be the same as those used at floor level. By adopting this design, planners provide additional activity space on the deck and in the area under it. The depth of the deck depends upon the number of bleacher rows. Temporary bleachers should be thoroughly inspected before they are used, and their capacity should never be taxed.

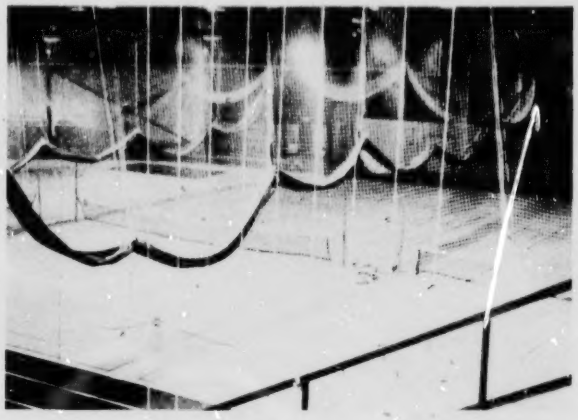
Balconies may be constructed to provide seats to supplement retractable bleachers at court level and on the elevated deck. They can be either a continuation of retractable bleachers or elevated above them and extended partially over the seating at a lower level. Balcony seats may have backs or be similar to those for stadiums.

When permanent balconies are planned, they should be constructed without supporting pillars that would interfere in any way with the playing or visual area. They should be served by ramps connecting directly, or by means of wide corridors with convenient entrances and exits. Ramps have a slope of at least one-foot rise in 12 feet. Minimum landings are 5 by 5 feet and extend at least one foot beyond the swinging area of a door. The ramps should have at least a 6 foot clearance at the bottom and level platforms at 30-foot intervals on every turn.

The fieldhouse should be so designed that the normal flow of traffic will not encroach upon the activity areas, to avoid interference with instruction and participation and to decrease maintenance costs. Permanent seating should be kept to a minimum in areas used primarily for instruction. Rollaway bleachers are preferable.

In areas designed primarily for basketball, spectators should enter and exit at a single level at various points around the circumference, from an exterior perimeter walkway. Designers may decide on the use of a continuous cross aisle

Figure 10
Net system at Rike Fieldhouse, Otterbein College



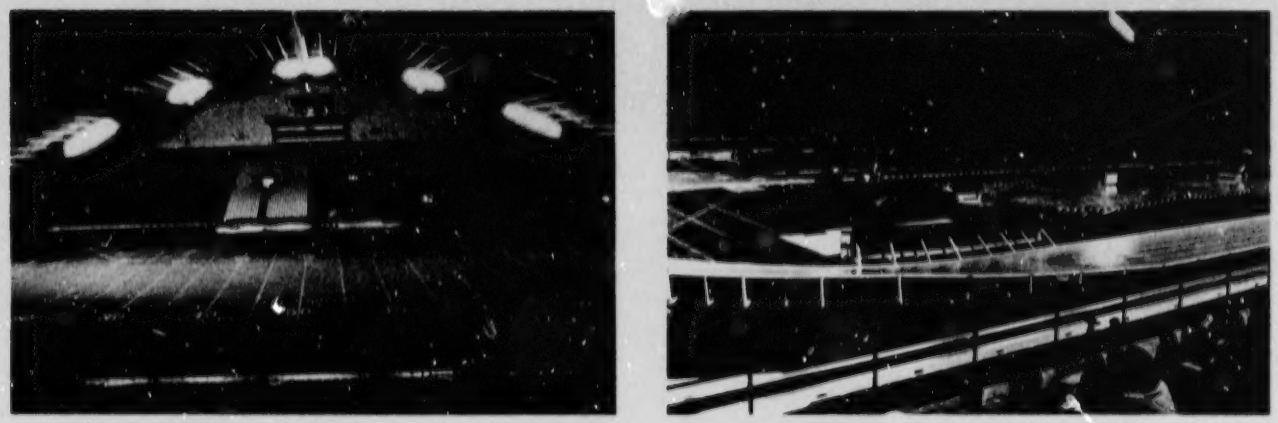


Figure 11
Two interior views of Idaho State Mini Dome shows flexibility of dome design

connected through the exit tunnel to the concourse. In such a design, all seats above this cross aisle are accessible only by means of stairs at each exit tunnel, while the lower seats can be reached from the vertical aisles connecting the main cross aisle. This system simplifies the flow of spectators to and from an event and allows for efficient management and control at one level. A portion of the lower seats are attached to telescopic platforms, which roll back into wall pockets when a larger arena floor is desired.

To determine requirements for ramps, stairs, exits, doors, corridors, and fire-alarm systems, planners should consult local and state laws and the recommendations of the National Fire Protection Association.

Accommodations for Public Events

Scoreboard and timing devices should be of sufficient number and so placed as to be readily seen by players and all spectators. They should be easy to operate and readily accessible for maintenance purposes. Provision should be made for installation of a public address system. Acoustical treatment of the building is desirable.

Accommodations for reporters, sports broadcasters, and talent scouts should be planned in the original design. Soundproof broadcasting and television booths should be provided for these services if the fieldhouse will be used for attractions of considerable public interest. At basketball games, however, the working press prefers to be as close to the action as possible and space should be provided at courtside.

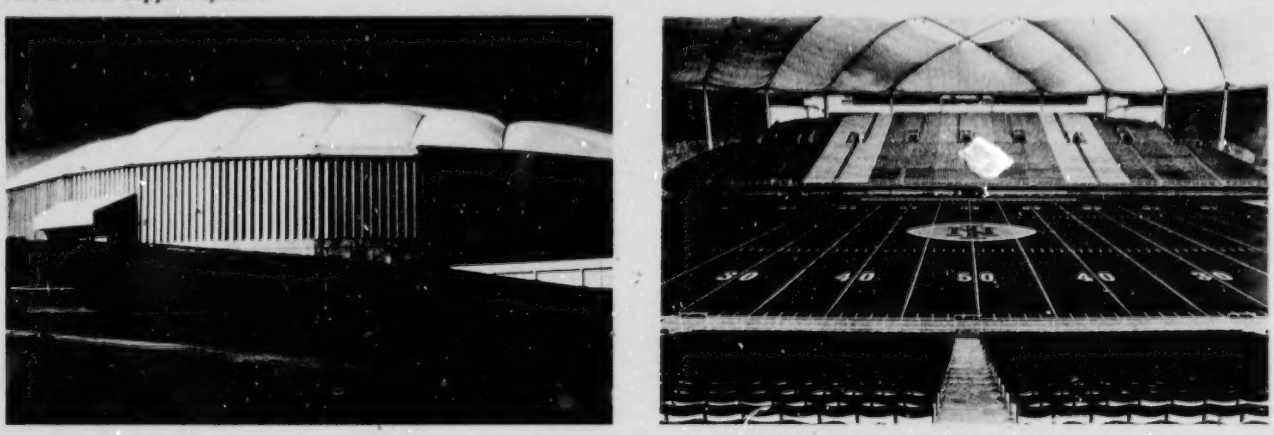
When the fieldhouse is designed to accommodate large crowds, concession booths should be constructed. They should be equipped with electric or gas stoves, sinks, running water, and sewer connections and should be located where they do not interfere with the normal flow of traffic. The booths should be accessible from all seats. Approximately 100 square feet per 1,000 spectators should be allowed for permanent concession booths.

Entrances and Exits

Entrances to the fieldhouse should be located with reference to parking and traffic approaches. Provisions should be made for a paved access roadway and at least one entrance large enough to accommodate trucks. The main lobby should be of sufficient size to accommodate anticipated crowds checking tickets and admission, particularly in northern climates.

The lobby should be so designed for ticket selling and collecting that the traffic will flow in a straight line, or nearly so, from the entrances to the box office to the ticket collectors. To avoid congestion, approximately two-thirds of the lobby

Figures 12 and 13
University of Northern Iowa Uni Dome has fiberglass membrane covering with Teflon coating. It has a cable suspension system combined with and air support system



should be planned for accommodating box offices and ticket purchasers. The remainder should be reserved for ticket holders, who should have direct access to admission gates.

The seating capacity and the number of seats in each section will determine the number of entrances and exits required. It is important that spectators be dispersed speedily. It is highly desirable to have exit ramps leading from stepped aisles. Ramps, stairs, and passageways should be as wide as the deck aisles served. Stairs or ramps not opening directly into a street or open space should have lanes of at least 20 feet in width leading out of the area.

Service and Auxiliary Units

If the fieldhouse is adjacent to the main gymnasium building and the natatorium, the requirements for lockers, showers, and toilets can, in some instances, be reduced. An underpass from the gymnasium to the fieldhouse may be desirable in order to make the gymnasium service units available to some participants in the fieldhouse. If the fieldhouse is not adjacent to the gymnasium, consideration should be given to the erection of a small building or basement, simple in design, with dressing, shower and toilet facilities, rather than use space for such purposes that might be used more advantageously for activities.

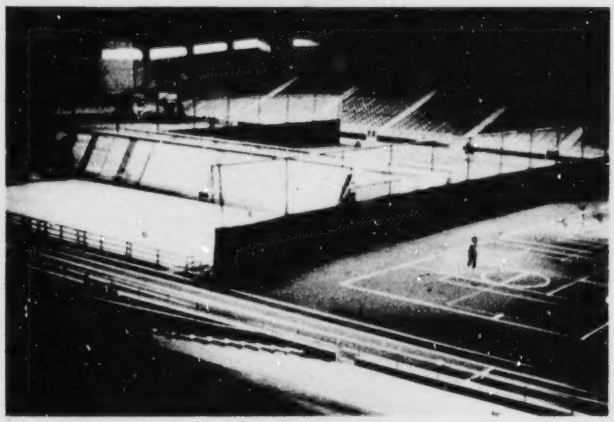
Convenient and accessible dressing units equipped with chalk and tack boards for the home and visiting teams should be provided. When the fieldhouse is to be used for interscholastic basketball tournaments and indoor track meets, consideration should be given to providing separate locker rooms with adjoining shower and toilet facilities. These units could be used regularly throughout the year by intramural participants and intercollegiate squads. It is desirable to provide passageways from dressing rooms directly to the basketball floor to avoid crowd interference.

A dressing room with adjoining shower and toilet facilities should be provided for staff members. These accommodations can also be used by game officials.

Separate toilet facilities in sufficient number for men and women spectators should be provided close to the seating areas. Toilets should be provided near traffic lanes. Where large crowds attend games, it is advisable to place supplementary toilet facilities off the main lobby.

A room for first-aid treatment should be provided if the fieldhouse program is planned to attract spectators. This room may also serve the purpose of a training room for emergency treatment of injuries.

Figure 14
University of Idaho Kibbe Activities Center



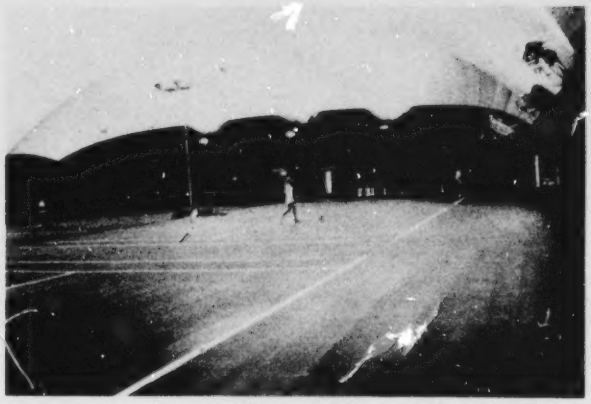


Figure 15
Olympia Swim & Racquetball Club in Columbus, Ohio, uses three large air structures to house nine tennis courts in winter

Provision for a lounge room may be advisable after consideration of such factors as available space and funds as well as the functions of such a room for clubs, members of athletic squads, letter men, officials and coaches, and visitors. An adjoining kitchenette is desirable.

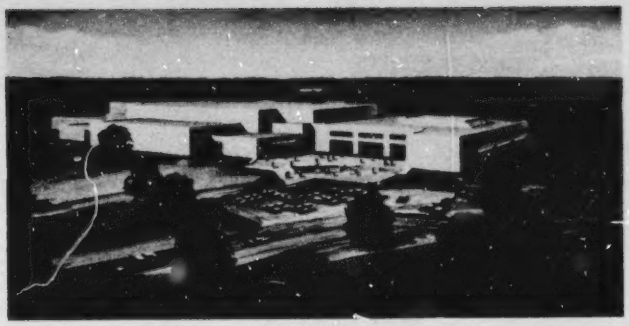
Storage Space

Many field houses are constructed with insufficient storage space. It is essential to have adequate and conveniently placed storage space if the facilities are to be fully usable.

Space should be provided for equipment and supplies for the physical education, athletic, and recreational programs. Supply rooms should be large enough so that supplies and equipment can be cared for and issued from them. Shelves in storage rooms should be slanted toward the wall.

After a building is completed, it is impossible to add storage space unless that space is taken from areas designed for other uses. Thoughtful planning of storage space should be done when setting forth total space needs. Adequate maintenance and control over supplies and equipment is possible only when proper storage space is available.

A major consideration in connection with storage is the provision of adequate entrances to storage areas. A loading dock and elevator may also be required, depending on the type of supplies and equipment to be used.



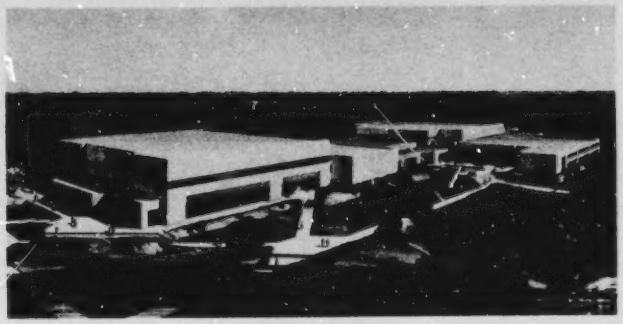


Figure 16
Plans for construction at Southwest Texas State University were developed in two phases

Figure 17
Sight lines and focal points must be established in planning bleachers

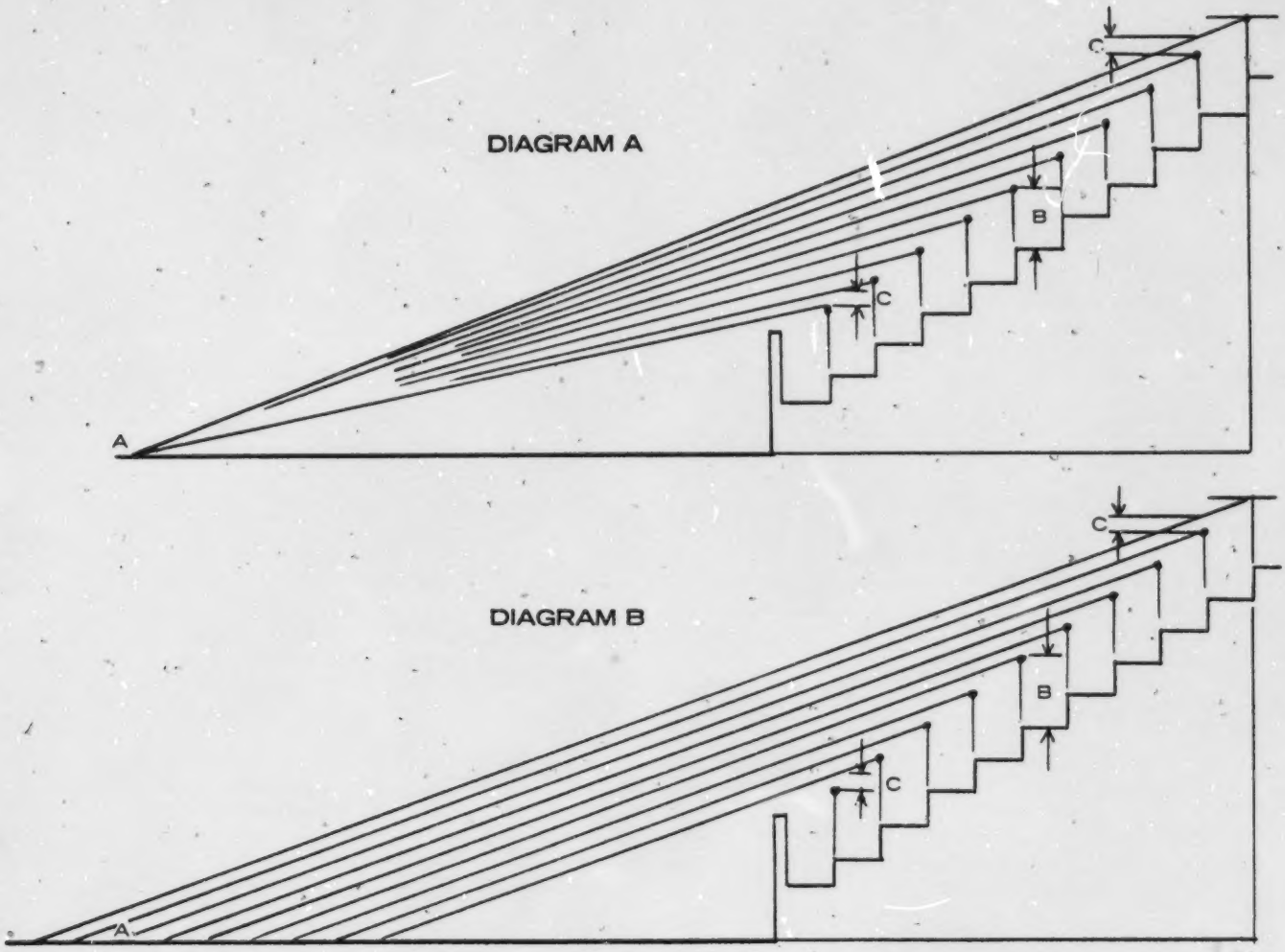


Diagram A shows a seating section with a gradual increase in riser heights. The focal points, "A," are same from all seats. "B" represents height from a seat eye level. "C" represents the distance from eye level to the top of a spectator's head.

Diagram B shows a seating section with constant riser and tread heights. As the seating tiers progress upward, each focal point is closer to the field.

These diagrams are adapted from *Concrete Grandstands*, Portland Cement Association, Chicago, 1948.

129

STADIUMS

This consideration of stadiums is primarily concerned with the type of structure frequently needed for school and community use, with a capacity of 10,000 or less and with limited spectator accommodations. It should be obvious, however, that the basic considerations for such structures will also apply to larger units. Those responsible for planning stadiums should keep in mind that their creation is an integral part of the physical education, recreational, and athletic programs of the school and community.

For the purposes of this section, the terms "spectator structure" and "seating structure" include both permanent and temporary outdoor seating facilities, while the word stadium refers only to permanent accommodations. Spectator structures provide seating from which people can satisfactorily view athletic events without inhibiting the activities of the participants. Seating structures can be justified more readily if they have multiple uses. In addition to serving athletic contests, these facilities can be used for concerts, conventions, patriotic observances, plays and pageants, lectures, commencement excercises, and other mass gatherings.

The space underneath a stadium may provide physical education and activity areas. These facilities should supplement rather than duplicate existing units.

Seating Capacity

If possible, the seating capacity of a stadium should be sufficient to meet present needs, with plans for expansion to satisfy predicted needs for a period of at least 20 years. The number of seats required will be influenced by the sports served; enrollment of the school or college; population and socioeconomic status of the town, city and region; and planned expansion of the program. The provision of an excessive number of seats should be avoided because construction and maintenance costs make it impractical to provide accommodations that are seldom used.

Design

Rectangular spectator structures provide the most practical seating accommodations for field games, tennis, outdoor basketball, volleyball, and other outdoor sports, and special events or demonstrations. For baseball, a structure can be located parallel to either the first-base or third-base lines. The most favorable view of tennis is from behind the ends of the courts. Seating facilities for other outdoor events should be adjacent to the activity area and as near as possible to the probable center of action consistent with the rules governing the activity.

Track-and-field spectator seating is generally parallel to the straightaway for the dashes. Some planners, however, have located spectator seating so that the structure angles gradually toward the straightaway end of the track. The front end of the structure nearest the starting line should be farther away from the track than the front end nearest the finish. This arrangement faces the spectators toward the most common center of continuing action.

The multiple use of a stadium for softball, baseball, and football often results from the desire to use existing floodlighting. In most cases, sufficient seating facilities can be provided with a small permanent structure or be relocating mobile bleachers used for football.

The combination baseball-football field should be avoided if possible, and especially if planners do not intend to use artificial turf. Superimposing an infield upon a portion of the gridiron makes undesirable viewing and playing conditions for football and soccer. A baseball area that overlaps a track-and-field site presents safety problems. Competitors have had serious collisions on such combined facilities.

Site and Location

A primary requisite for a satisfactory site is adequacy of size. The site must be large enough to accommodate the play and safety areas for the sport or sports to be conducted, the proposed present and future seating, and service areas. The site should be flat or easily leveled. However, natural inclines of the topography can be used for support or partial support of a structure. Surface drainage of a site and adjacent areas as well as the subsurface soils and geological formations should be considered.

Cities with two or more secondary schools should consider the construction of one stadium for their combined use. Teams from each school may practice on local fields and play their regular games at the stadium. If possible, the structure should be located on or adjacent to one of the schools' sites for reasons of greater accessibility, maximum use, and more efficient maintenance, operation, and supervision.

Seating Decks and Supports

The main considerations in planning spectator structures involve seating decks, deck supports, seats, and means of ingress and egress. Several factors should govern the selection of materials used for seating decks and deck supports, including expected capacity, intended use of the structure, availability of funds, climatic conditions, and desired aesthetic qualities.

Wood, stone, brick, steel, and reinforced concrete are the materials most frequently used. The inclusion of service and other facilities under the stadium makes mandatory a solid, continuous, and waterproof deck of either concrete or metal. Wooden treads and risers may be used if the underneath area will not be developed. Appearance, tensile strength, adaptability, exhaustability, durability, and cost of construction and maintenance are items that should guide the buyer in the selection of building materials.

Concrete, structural steel, wooden columns, and natural or artificial embankments serve as supports for decks of spectator structures. Reinforced concrete columns are generally used to support most wooden decks. The supporting structure of the stadium should rest upon foundations of concrete. The design of deck support should meet structural strength requirements of state and local building codes, and the supports should be so located that they provide unobstructed spaces of the appropriate dimensions to accommodate proposed uses of the underneath portion of the stadium.

Stress standards should be considered at all times in stadium construction. Regardless of the materials used, all spectator structures should be designed to meet the following specifications: to support, in addition to their own weight, a uniform distributed line load of not less than 100 pounds per square foot of gross horizontal projection; to resist a horizontal wind load of 30 pounds per square foot of all vertical projections; and to withstand a seat load of 24 pounds per linear foot of seats and a force of 10 pounds per linear foot applied in a direction perpendicular to the seats' length. Seating standards require that all seats and footboards carry line loads of not less than 120 pounds per linear foot.

Bent steel plates may be used in the construction of steel

decks (prefabricated sections of treads and risers). This type of deck affords flexibility in expansion. A facility of this kind may be salvaged and moved to a new site, and it is sturdy, durable, and watertight (if welded) structure. However, steel plates do tend to deteriorate if not painted regularly.

A structure with a seating capacity of less than 5,000 persons might be constructed of wooden treads and risers mounted on concrete, steel, or wooden substructures. The advantages of this type of construction are lower cost and portability. Deterioration of the wood and the almost constant maintenance problems are disadvantages.

Treads and Risers

In the seating deck of a spectator structure, the treads form the horizontal surface while vertical surfaces form the risers. To minimize expense, treads and risers should be as small as possible but sufficient in size for comfort and good view. The height of the first riser should be kept to a minimum because it affects the ultimate height of the entire structure and, therefore, the cost. The width of the treads is governed by factors of economy and comfort. A minimum depth of 24 inches is recommended for treads with backless seats. For structures without continuous seating decks, this measurement should be taken between the front edges of the seating surface of successive tiers. The minimum depth for tread supporting seats with backs is 30 inches. Tread widths remain constant except for the first tier, unless there is a railing, low wall, or fence in front; in which case, additional space is required for spectator movement.

Drainage must also be considered in the design of treads for solid decks. A forward slope of one-half to one inch per tread will permit water to drain off rapidly, in addition to facilitating hosing the deck for cleaning purposes. Gutters and drains should be included for large structures. The standards for the size of the drain are based on the minimum ratio of one square inch to each 300 square feet of deck surface served.

State and local building codes set standards for aisles, entrances, and portals for spectator structures. Planners should be cognizant of such codes. Aisles may not be necessary in small seating structures. For structures with many rows and larger capacities, however, aisles are necessary. Sections between aisles should contain tiers with 21-32 seats.

The first aisles should be located 11 to 16 seats from the ends of the structure. Horizontal walks are generally undesirable because persons using them will obstruct the sight lines of others. If such walks are used, the next tread above should be high enough to permit the spectators to look over those persons walking in front of them. In addition, the first tier of seats should be high enough to allow its occupants an unobstructed view.

Aisles should have a minimum width of 36 inches, and if divided by a portal or obstruction, each side should be at least 21 inches wide. Whenever the riser exceeds nine inches, an intermediate step is necessary.

The seating capacity and the number of seats in each section will determine the number of entrances and exits required. It is important that spectators be dispersed in a minimum amount of time. It is highly desirable to have exit ramps leading from stepped aisles. Ramps, stairs, and passageways should be as wide as the deck aisles served. Stairs or ramps not opening directly into a street or open space should have lanes of at least 20 feet in width leading out of the area.

Deck Walls and Railings

The ends, backs, and in some instances the fronts of the seating structures should be bordered by walls or a railing. These walls or railings should extend at least 12 inches above the treads and be designed to prevent spectators from sitting on them.

Sight Lines

Seating facilities should be constructed to provide spectators with a good view of the performance. Nearness and an unobstructed sight line to the desired points affect the quality of the accommodations. A sight line is a straight line from the eyes of the seated spectator, over the heads of others below, to a point on the field that represents the spot nearest the structure that should be in his field of vision.

Recommended focal points for sight lines are as follows: for football, the nearest side boundary lines; for baseball, several feet behind the catcher; for track, about knee-height of the runner in the nearest lane; for side seating tennis, four feet in toward the seats from the doubles boundary line; and for end seating for tennis, 10 feet behind the base line.

Seating Arrangements

Considerations involved in the design of seating facilities include the nature of the contest, the comfort and convenience of spectators, proper balance of cost and comfort, stadium cleaning, and maintenance expenses.

Back supports are generally unnecessary in stadiums because of the nature of the activity and the added cost of such supports. For planning purposes, an area of two by two feet, or four square feet per seat, should be allowed for bench seats. The height of the seats above the foot-support treads should be between 16 and 18 inches. Some designers make no allowance for seating other than directly on the treads. However, elevated bench seats are much more satisfactory.

Lighting and Electrical Facilities

General lighting and electrical outlets should be planned to satisfy the requirements of the specific spectator structure. If night games are to played, illumination is necessary for all areas to be used by spectators. The playing areas should receive extra illumination in situations where the last row of seats is several hundred feet away from the action on the field. Uniform illumination is necessary for proper player judgement of the ball and its trajectory. Lighting also must now be provided in terms of footcandles required for filming and television. Standards for the design of floodlights are published by the Illuminating Engineering Society.

Manufacturers have a wide variety of lighting systems, direct and indirect. Some of the most popularly used systems are mercury vapor, fluorescent, incandescent, luminaries, quartz-flood, filament, Lucalox, and multi-vapor.

Communication Facilities

Accommodations for reporters, sports broadcasters, television and motion-picture cameramen, and scouts should be planned in the original design. The football press box should be located opposite the 50-yard line, preferably on the west side of the stadium. Baseball press boxes usually occupy some portion of the stand behind home plate, and tennis matches can best be served by a press box behind the end of the courts. A means of communication between the press box and the field is necessary.

Douglas fir, redwood, and southern cypress are the woods most used for bench construction. Such factors as decay resistance, bleeding, strength, slivering and cross-section of grain warrant consideration in selecting the kind and quality of wood. Types of commercial covering that protect and aid in the maintenance of wooden seats should be investigated. Synthetic materials of plaster, Fiberglas, and the like, molded into seating structures, are now past the experimental stage. Extruded aluminum, natural in color, is fabricated into seats and may be found in many modern stadiums. The natural type is neither hot nor cold, withstands weather, defies insect destruction, and drains and dries quickly and cleanly.

Developing Space Beneath Stadium

The space underneath stadium seating can serve a variety of purposes. Planners should not consider service units in this section of the stadium if no more than 15 rows of seats are contemplated. Under-stadium development is economically advisable only if the cost of construction of needed facilities is less than it would be at other available sites. Many colleges and universities may find it more feasible to develop the area underneath the stadium than to have the various functions that might be served there dispersed to more remote areas.

A variety of uses can be made of this space. The most common facilities to be located in this area are public toilet rooms, storage rooms, concession booths, and dressing rooms for competitors. Activity areas, classrooms, and office might also be included in this area. In larger stadiums one or more lounge rooms for pregame meetings and/or luncheons with the press or other similar purposes might be provided. Other possibilities include auditoriums and band rooms, dormitories and dining halls, instructional areas, maintenance shops, housing for the caretaker, basketball courts, auxiliary gymnasiums, practice facilities for baseball and track, and squash and handball courts.

Steps in planning the area under the stadium include a determination of the capacity and type of the proposed structure, a study of other present and probable future facility needs, and a determiniation of which needs can best be satisfied through development of the space. Three important questions should be answered in determining the feasibility of developing this portion of the stadium. Is it possible to construct the facilities in keeping with previously determined requirements? Will these facilities permit the intended use? Is it economically practical? If the space under the stadium is to be developed, other important factors that should be considered are whether the structure is above ground and/or of permanent construction; whether the seating deck is watertight; the space requirements of the various facilities, which will indicate the location and design of columns, trusses, beams and other supports; and whether the substructure is designed to support the seating deck and, at the same time, provide a framework for the construction under the stadium.

Ramps, stairs, walks and other stadium service facilities should be located to satisfy the intended purpose, but also with consideration of facilities under the stadium. Common errors made in the development of this area are the failure to provide a watertight seating deck—with the necessary inclusion of expansion joints—and insufficient windows and ventilation.

Field Surface

Every consideration should be given to the latest developments in surfacing. The basic functions to be served by the stadium in the particular institution will determine the final selection. With the exception of cost, there is no longer any reason to have dirt areas that become mud areas on playgrounds or fields. With artificial turf, the use of an outdoor field can be increased 300 to 600 percent in a normal winter. Football stadiums can be designed to serve baseball and track. They may also be designed to use the same lights. Artificial turf can be used all day, everyday, by everyone.

Artificial grass is feasible since it causes no allergies, or baldheaded fields, and it is good for all grass sports—soccer, golf, tennis and lawn bowling. There are other synthetic surfaces that service smooth surface sports such as basketball.

Provision should be made for a press box in the original design of the stadium. It should be of sturdy, permanent construction and should be high enough to permit the occupants to see over the spectators standing in the row immediately in front. It should be heated and enclosed, with a glass front.

In cold climates, consideration should be given to providing an area for sports photographers at either end of the press box. A protected and heated structure providing overhead cover, with an open area in front from which pictures could be taken, might be constructed for a nominal sum.

Stairs and/or an elevator should provide access to the press box, and the latter is recommended if the press-box floor is more than 30 feet above ground level. Public toilet facilities should be immediately adjacent, with a minimum of two water closets, or one for every 10 occupants.

Additional Accommodations for Public Events

Scoreboards are essential for football, softball, and baseball fields. Time clocks are also desirable for football.

It is advisable to have the scoreboard designed as an integral part of the structure, especially in the case of larger stadiums. For activities attracting a small number of spectators, mechanical or movable scoreboards may be practical.

One public telephone should be provided for every 1,000 spectators, with a minimum of two for the stadium regardless of the seating capacity. Booths should be enclosed to eliminate noise and should be placed in accessible locations.

For suggestions on concession booths and dressing units for participants and staff, see the discussions in the section of this chapter on fieldhouses.

The availability of electricity, gas, water, and sewer connections significantly affects the use and validity of a spectator structure. The concession center, press-box area, rest rooms, scoreboard operations, field illumination and watering, and many other functions depend on one or more of these utilities.

Public toilet units should be located in an area that is easily reached from the seating area. Because the stadium structure is ordinarily not heated, all plumbing should be constructed so that it can be completely drained of water, and water lines should be buried beneath the frost line of the locality. Toilets used by large groups should have circulating (in and out) entrances and exits.

Stadium cleaning can be expedited by providing the recommended deck slope and drains with hose bibbs located not more than 100 feet apart. Paving the surface under the stadium seats and installing drains and hose bibbs designed to prevent freezing facilitates stadium cleaning.

Provisions For Future Expansion

If there is a possibility that the size of the stadium will need to be increased in the foreseeable future, the method of

expansion should be determined and the necessary details incorporated in the original footings and other construction. Insofar as possible, the requirements for future expansion should be built into the initial structure.

THE ICE ARENA

The ice rink is a highly specialized area and should be planned at the same time you are planning the building. Enlist the help of experienced ice rink people. The planning committee should visit as many rinks in operation as possible and talk to the owners and managers. Many worthwhile construction and operation pointers can be gathered from these experienced people.

Planners should first define the objectives and purposes of the skating facility.

- To solve a community need?
- To be revenue-producing?
- Single-purpose or multi-purpose?
- Spectator or non-spectator?
- Types of skating to be accommodated? Public skating? Youth skating programs? College and/or high school hockey? Amateur hockey? Semi-pro hockey? Pro-hockey? Hockey tournaments? Figure skating? Instruction? Ice shows?

From the above, you should be able to establish the requirements of location and size, accessability, parking area, etc.

- Spectator seating needed
- Inside service areas required (skate sharpening and rental, pro-shop, locker-rooms, etc.)
- Skater and public entrances and exits
- Estimated cost of land, building, rink equipment and its installation
- Length of year rink will be operable

An estimate of the cost of the structure can be determined when these requirements are defined. If the project is financially feasible, an architect can be selected and planning can begin.

Building Size

The building size will depend on the types of events accommodated in the structure. However, the recommended size for the ice surface is 85 feet by 200 feet. The rink should also include at least 4 dressing rooms, refrigeration room, ice resurfacer storage room, which is accessible to the ice surface. The clear span portion of the building need only cover the rink, plus seating.

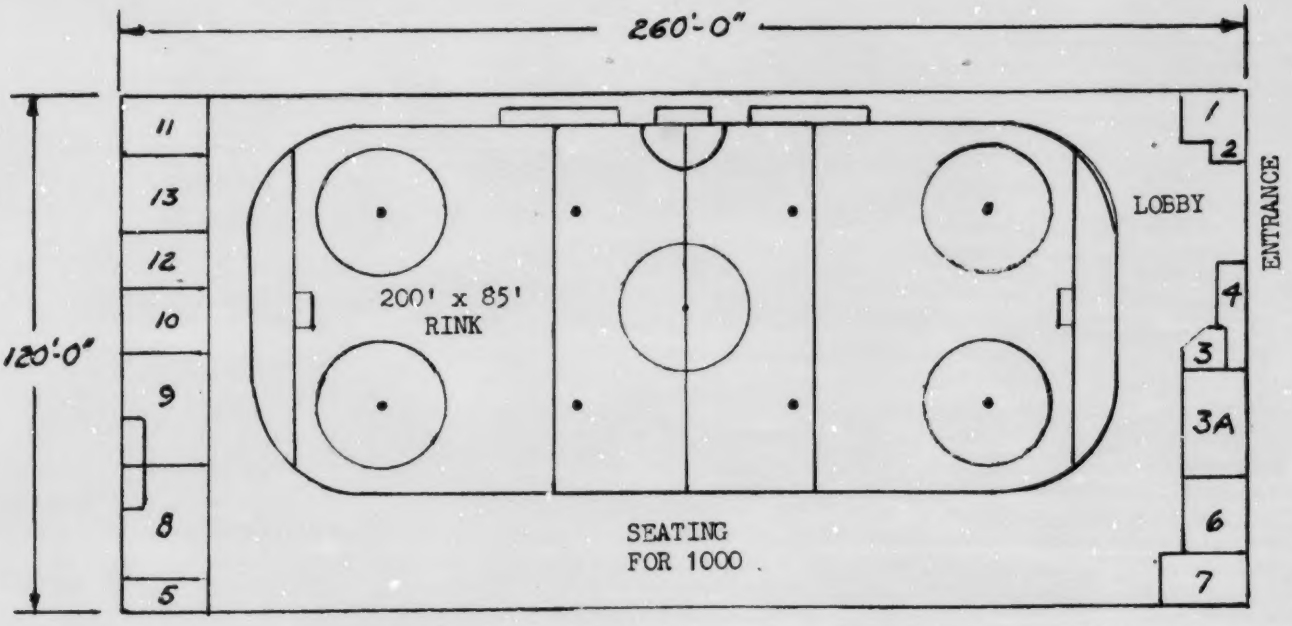
The number of seats desired will depend on the planned programs, but remember that the width of the building will determine to a great extent the number of seats. It will cost more to increase the width of the structure than the length. The minimum width needed for 1,000 seats plus ice width, dasher boards, walkway in front of seats, players, seat width at 2½ feet per row, benches, penalty bench, scoring tables is approximately 120 feet.

Length of the building will depend on whether all facilities will be included under one roof or if a block building is added for dressing rooms, refrigeration room, offices etc. Figure 18 is for a building 260 feet long and 120 feet wide under one roof. Another typical layout with minimal seating is Figure 19.

Refrigeration

It is very important to choose the right type of refrigeration system along with a competent and reliable installation company. In selecting an ice rink installer, the following qualifications should be weighed: education and experience of company directors, age of the firm, qualifications of its

Figure 18



-From Charles R. Beltz & Co., Grosse Pte., MI

personnel, list of rinks designed and volume of business during last four years.

Before a final contractor is selected, the committee should visit numerous rinks constructed by each potential installer and talk to their owners, managers and engineers. Determine if there was satisfaction with the installation, training of personnel to run the system and follow-up to problems that developed. Study the records of operation of the refrigeration system with respect to expense for energy and operating personnel.

Producing and maintaining a good ice sheet is imperative to any rink operation. If there is a breakdown in refrigeration and you lose your ice, your programs are lost for that time. In privately-owned rinks, money is lost which will never be recovered. Remember: in refrigeration there is no such thing as "cold". Cold is the absence of heat. With this in mind, it will be much easier to understand and evaluate ice rink refrigerator systems. Heat is absorbed from a material when it comes in contact with a material having a lower temperature. In the case of refrigerants, this heat-absorbing quality is increased by the ability of the refrigerant to change to a gas which produces a greater cooling or freezing effect.

Basically there are two types of refrigeration systems: the Indirect brine system and the Direct system with two variations (Direct Liquid Refrigeration "DLR" and Direct Expansion "DX").

The Indirect method is the oldest system used in ice rink refrigeration. Rapid progress in ice rink refrigeration started in the 1930's and 1940's when Dupont developed Freon refrigerants. Before that time, because of high installation, maintenance and operating costs, only wealthy municipalities could afford ice rinks. Also ethylene-glycol was developed as a possible replacement for calcium chloride (salt) for use with water as the brine in indirect systems. Ethylene glycol is non-corrosive and made possible substantial reductions in refrigeration equipment size. The calcium chloride unit must be monitored faithfully to prevent chemical imbalance which can produce unwanted scale within the distribution network or acidify sufficiently to accelerate deterioration not only of its own components, but those of adjunct equipment as well.

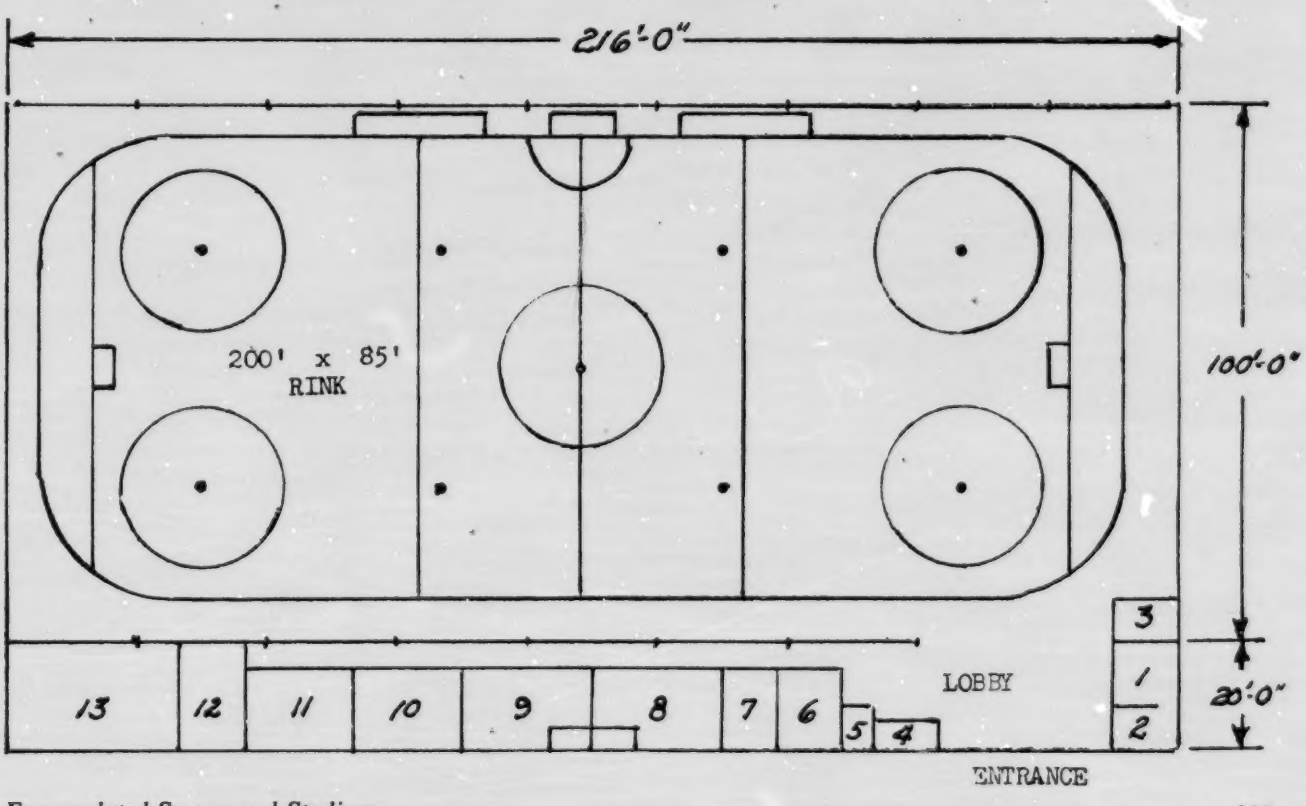
Both systems use compressors and condensers. The compressor is that part of the system that compresses gaseous refrigerant. During the compression process the gas becomes hot and is pumped under high pressure by the compressor to the condenser. The condenser is a heat exchanger that liquifies compressed refrigerant gas.

The Indirect system (Figure 20) uses a brine pump and if the pump fails, the system is not operative. Two of these centrifugal pumps should be built into the system to eliminate this possibility. One would be used as a standby in case the other fails.

The indirect brine system is a two-step system. First a refrigerant, either ammonia or Freon 22, is pumped through a series of pipes in a brine chiller, where the brine is chilled to a temperature considerably below the freezing temperature of water. The chilled brine is then pumped from the brine chiller through the pipes in the rink floor which in turn absorbs heat from the water and freezes the rink floor. Because the refrigerant does not go through the piping in the rink floor, the system is called indirect. "Brine" is only used in this system and not in the direct system.

In the direct system (Figure 21), refrigerant is used

Figure 19



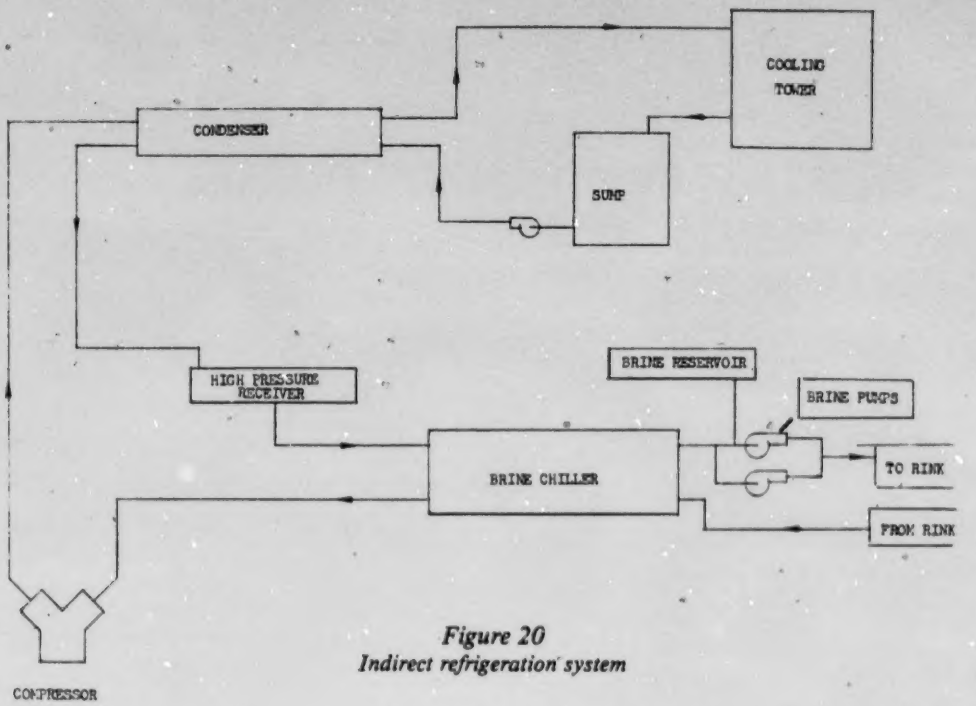


Figure 20
Indirect refrigeration system

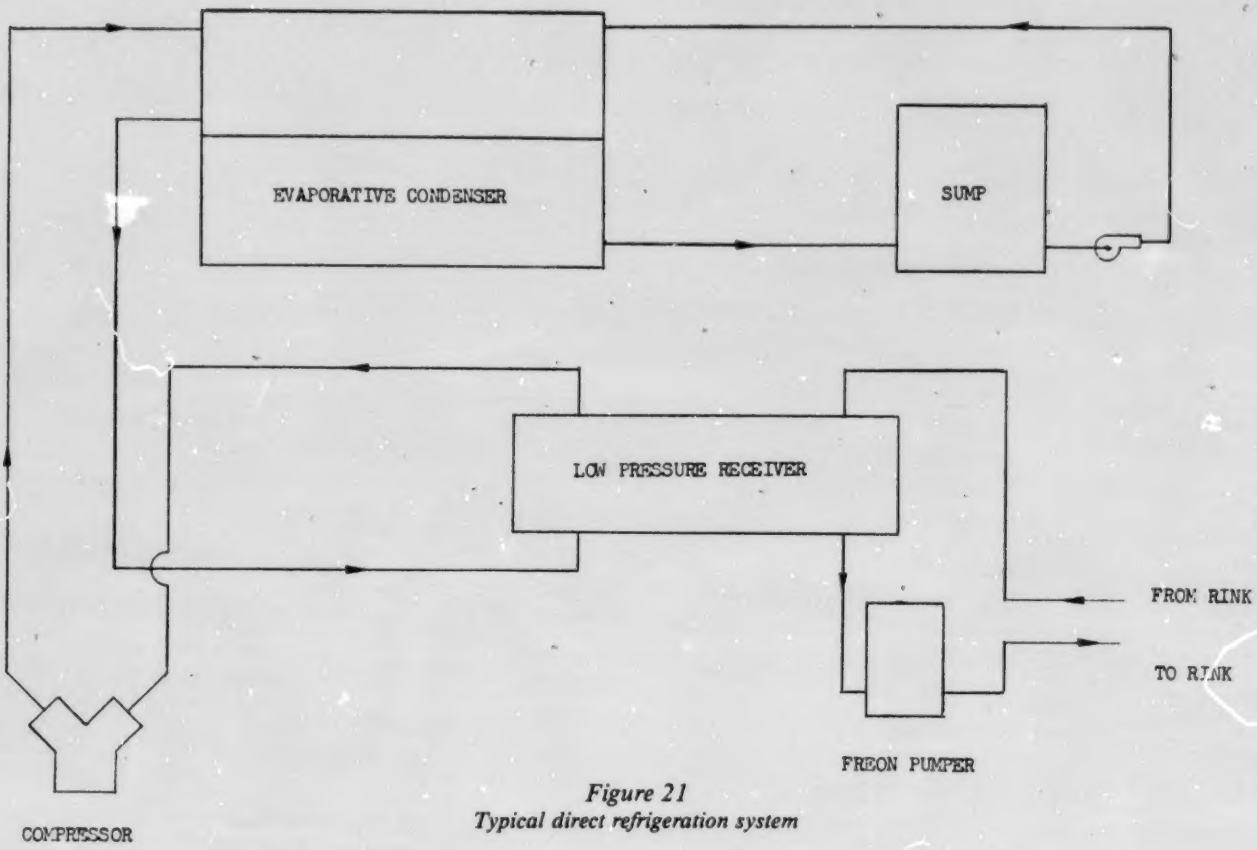


Figure 21
Typical direct refrigeration system

throughout the entire network. It is supplied directly through the rink floor pipes. Freon 22 is both the refrigerant and chilling agent. It is highly dependable, stable and has excellent safety features. With this method the brine chiller and pumps are eliminated. There are two variations of this system. The direct liquid refrigeration "DLR" and the direct expansion "DX".

The "DLR" system is pumpless with no moving parts; only float valves which open and close automatically. Discharge pressure from the compressor is used to mildly pressure the transfer tank which feeds "cold" liquid Freon under low pressure to the rink floor pipes. There are no restrictions in the rink floor perimeter feed pipes. As the Freon 22 flows through the rink floor piping, it draws heat from the water or ice causing the water to freeze or the ice to freeze harder. Skaters generate heat in the area where there is skating activity. Any change in the ice temperature at any place in the rink causes an immediate pressure equalization throughout the entire rink field system. An in-ice thermostat is used to signal changes in temperature and works automatically.

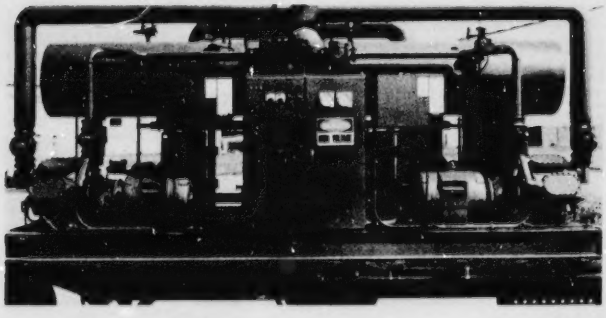
The direct expansion system "DX" differs from the "DLR" in the following manner: Freon 22 refrigerant is pumped under high pressure from the compressor-condenser into a holding tank which feeds the perimeter feeder pipes around the rink floor. The refrigerant is then forced under high pressure through a series of expansion orifices at the head of each run of pipe in the rink floor. There are approximately 255 runs of pipe in a rink floor, so it has 255 individual orifices.

Until a few years ago the refrigeration unit was assembled on the job, but now installation time and costs have been reduced by the development of the "packaged" ready-for-hookup refrigeration unit. It is shipped to the job site ready to hook up to the rink floor. The unit has been pre-assembled, pre-wired, pre-insulated and pre-tested for immediate use at the new arena. Figure 22 is a typical pre-assembled unit on a railroad flat car.

The Planning Committee should ask representatives of each type of system to give a presentation. One system will not satisfy every need. However, in choosing the rink installer it is recommended that the company chosen assume total responsibility for all the equipment, installation and satisfactory operation of the rink, along with training rink personnel. Insist that the installer of the refrigerator system be responsible for the entire rink portion of the facility. In this way, only one company need be consulted.

Energy Conservation

Conservation of energy is a critical consideration and promises to become more important. Three things determine the energy requirement for an ice rink system:



1. Horsepower needed to operate the refrigeration equipment, compressors, condenser, pumps etc. The size and number of the operating components of the refrigeration system determines the horsepower needed to operate the unit. The higher the horsepower the more in cost per month for operation.

2. The more efficiency that is designed and built into this unit, the less the refrigeration equipment will need to be running.

3. Rate of efficiency loss of the refrigeration unit and system over a long period of time. Causes of efficiency loss are corrosion, mineral deposits and oil accumulation in the entire rink network.

The direct refrigeration unit uses less power to operate than the indirect. The direct unit uses smaller compressors, no brine chiller, does not need two brine circulating pumps, all energy users. In the brine system, the refrigerant has to be chilled to a temperature of 10°F to 15°F colder than the brine temperature.

With direct liquid refrigeration the refrigerant in the rink field need only to be cooled to the temperature of the rink floor. This means that the indirect system must be in operation longer and at a less efficient, lower compressor pressure. It stands to reason that if a system operates longer at a less efficient manner, the cost rises. It has been learned by comparison of the two systems operating at peak efficiency that there is a savings in electrical power of approximately 30% with direct refrigeration.

Ice Hardness

All ice for skating is not the same. The best temperature for each type of ice activity is as follows:

Hockey	15° - 17°F (Hard Ice)
Pleasure Skating	17° - 20°F (Softer than for hockey)
Figure Skating	20° - 22°F (Reasonably fast ice, but skates cut into ice)
Curling	(Soft ice without melting)

Rink Floor

After the selection of your refrigeration unit, the next key portion of your project is the construction of the rink floor. the rink floor can be constructed in different ways—steel pipes in concrete, steel pipes in sand, plastic pipes over a hard surface covered with sand. Steel pipes in concrete is preferred. This is the most expensive, but over the long haul will prove to be the most practical.

If the rink is to be a single purpose rink for skating only, a sand floor will give satisfactory service and is lower in initial cost. However, a sand floor is more costly to operate because sand is inferior to concrete for heat conduction.

The use of plastic pipe is not recommended except for use in small portable rinks. The efficiency of the refrigeration, using plastic tubing, is less than using steel pipes. Plastic tubing does not conduct heat as well as steel pipes. The only advantage to plastic piping is lower initial cost. Also, plastic pipes cannot be used with the direct system.

Before the rink floor can be poured, the sub-soil must be tested to establish the water table. The presence of water in the sub-soil within four feet of the rink floor can cause heaving

Figure 22
View of a pre-assembled refrigeration unit

Figure 23
Hockey arena at Michigan State University

of the floor due to freezing and expansion of the soil under the rink.

If there is a possibility of water at a depth of less than four feet under the rink, one or all three of the following things can be done: (1) a drainage system in the sub-soil, (2) removal of the moisture-holding soil and replacement with a non-wicking type fill and/or (3) installation of sub-soil heating. Sub-soil heating is inexpensive to operate because waste heat from the condenser is used to heat the antifreeze which flows through the pipes embedded in the sub-soil. This weak solution of glycol is maintained at a temperature of 40°F by a thermostat. This means that during the operation of the rink, the temperature of the sub-soil never drops below 40°F and never freezes.

Most rinks built today are insulated by using two layers of 2-inch thick polystyrene foam directly under the rink floor. This insulation prevents the transfer of heat from the sub-soil to the rink floor. A vapor barrier of polyethylene film separates the insulation from the concrete or sand floor.

In a full-size 85' x 200' rink there are approximately 51,000 running feet of pipe. This pipe covers the total rink floor and is spaced 4" on center. The concrete floor must be poured in one continuous pour at a depth of 5 - 6 inches and be separated from the surrounding concrete floor of your building. The grid piping is only one inch below the surface of the rink floor to assure dependable and efficient freezing of the ice surface.

There are approximately 2805 pipe connections in the standard size rink. This means that leaks in the rink floor are a possibility unless a professional job of coupling or welding is accomplished at each connection. Welding is the best choice if you have good quality control. One recent development is the use of steel tubing which has no welded connections from one end of the rink to the other. Using this tubing the possibility of leaks in the rink floor is minimal.

Double Rinks

There is a trend in some metropolitan areas to construct a double rink. The typical double rink has a full-sized rink for hockey and public skating and a smaller rink (at least 5000 sq. ft.) for instructional and figure skating.

Dehumidification

Dehumidification in ice rinks is a low cost way of removing fog and condensation problems that occur in a rink area during the hot humid months of the summer. Air conditioning the rink area is seldom necessary. However, in southern climates it may be desirable to air condition other parts of the rink, especially the spectator area, locker-rooms, offices, etc. Remember that dehumidification just removes moisture from the air and is by no means a substitute for ventilation.

Heating

It is recommended that the building be maintained at around 50° - 55°F at all times. If a crowd is expected, a lower temperature should be maintained because body heat from the crowd will raise your building temperature 10° -15°F. Office space along with locker-rooms and showers should be maintained at around 65° - 70°F. The heating fixtures should never circulate warm air directly over the ice surface, because of the added load this puts on your ice making equipment.

All types of heating methods are used, so consult a heating and ventilation contractor for the system best suited to your arena. One recently developed heating factor is using the

waste heat from the compressors to help supplement other heating apparatus in the building.

Dasher Boards and Protective Screening

Every ice rink which is built for a full schedule of ice activities needs dasher boards and protective screening. Dasher boards can be made of marine plywood or the newer high density polyethelene material. Plywood is serviceable, but almost impossible to remove the black puck marks on the white boards and must be painted often. The synthetic polyethelene dashers are about the same in price, clean up well and give an attractive appearance to your rink. A 6-inch to 8-inch kick board around the bottom of the dasher should be made of the same synthetic and in a contrasting color.

The frame for the dasher boards and protective screen should be solidly built to withstand the constant impact from the hockey pucks and the shock of body checks. The dasher boards should also have entrance and exit doors for your player benches, doors for penalty boxes and public skating sessions, also a 10-foot-wide door for the ice resurfacer to enter and exit. Doors should never swing towards the skating surface.

The protective screening around the rink can be made of plastic netting, wire mesh or of clear acrylic glass. The height must be at least 4 feet and preferably a few feet higher. Plastic netting is easily torn; wire mesh can be dangerous because of sharp edges. Acrylic glass is more expensive, but easier to see through for spectators.

Locker-Rooms

At least four locker-rooms are a "must" in any arena which plans to have hockey as a money maker. The rooms should be at least 12 by 20 feet to accommodate the normal team. Four locker-rooms are suggested so two teams may be on the ice and two teams dressing or undressing at the same time. Showers with the proper number of shower heads should be in close proximity to each locker-room. Thievery is a problem in any locker-room and special attention should be given to security measures.

Floor Covering

In all areas of the rink where individuals will be walking with skates, it's imperative to have a floor covering which will not be injurious to the skater or skate blades. Indoor-outdoor carpeting, rubberized matting, or poured-in-place synthetic materials are available. Carpeting is the least expensive, but creates a cleaning problem and skaters can cut the surface. Rubberized interlocking skate tile can be purchased at an intermediate price and is easily cleaned and comes in many colors. The poured-in-place synthetic is very good quality, but quite expensive when compared to the other two coverings.

Scoreboard

For competitive play, a scoreboard should be installed. It gives the arena a professional appearance and the spectators and players can easily follow the game. Many arenas sell advertising on the scoreboard to offset the expense of the purchase.

Combined Skate Shop and Pro Shop

The skate shop and pro shop, if run efficiently, can help defray cost of ice [illegible] maintenance. The rooms do not have to be especially large, but the skate shop should have enough space for skate rentals and a skate sharpening operation. Remember that proper ventilation must be provided for the skate sharpener, so that the residue will be eliminated from the air. The pro shop would retail skates, hockey sticks, pucks, friction tape, skate laces, and other paraphernalia that will be used for your arena programs.

Lighting and Sound System

Knowledgeable lighting and acoustical engineers should be consulted about the systems to be installed in the arena. Incandescent, fluorescent and high-intensity discharge lights may be used separately or in combination. Banks of lights should be wired to separate switches, since there are times when a minimum of light is necessary and desired. When planning other electrical outlets, don't forget proper wiring for scoreboard and goal lights.

Sound systems are important in every arena because public skating requires taped or recorded music. Also regular day-to-day activities and hockey games will require announcements. Acoustics over ice presents special problems, so experienced personnel should install the sound system and speakers.

The following items should also be remembered when planning your Ice Arena:

- Ice resurfacer storage room, with pit and drain for dumping ice shavings
- Hot water outlet adjacent to ice resurfacer
- Adequate public rest rooms and drinking fountains
- Offices
- Rental lockers
- First Aid room and training room
- Public phones
- Concession areas
- Workshop
- Adequate parking around arena
- If arena is used for collegiate or professional hockey, provisions for radio and television, press box, and ticket booths need to be provided. The most recent edition of the NCAA Ice Hockey Guide also should be consulted.

CHECKLIST FOR ENCAPSULATED SPACES

1. Provide ample space for the activities desired. _____
2. Include adequate administrative, recreational, and service facilities. _____
3. Design for future needs. _____
4. Provide accommodations for men and women. _____
5. Provide drainage around the exterior of the building. _____
6. Provide adequate storage space. _____
7. Install proper lighting. _____
8. Provide for maintenance of light fixtures. _____
9. Provide adequate wiring with provision for high-voltage current. _____
10. Provide windows and skylights with minimum glare intensity. _____
11. Install sufficient and well-placed heating vents. _____
12. Provide for sufficient natural ventilation. _____
13. Include adequate exhaust fans and vents. _____
14. Provide well-placed ticket-sale and ticket-taking facilities. _____
15. Provide for telephone, television, radio, and telegraph facilities in the press area. _____

16. Provide an adequate sound system. _____
17. Provide an entrance large enough for the delivery of equipment. _____
18. Provide waterproof insulation for the ceiling. _____
19. Place pipelines an adequate distance from the floor. _____
20. Provide sufficient shower and locker facilities. _____
21. Install an adequate public-address system. _____
22. Include adequate facilities for cleaning and maintenance. _____
23. Include sufficient water outlets. _____
24. Provide for expansion or change. _____
25. Provide for portable facilities. _____
26. Plan for accommodation of spectators in areas where needed. _____
27. Provide well-designed spectator exits. _____
28. Include an adequate lobby and vestibule. _____
29. Provide a sufficient number of electrical outlets, and place them for easy access. _____
30. Select good paint colors for the interior of the building. _____
31. Place windows away from goals and goal lines. _____
32. Provide filters in the air-circulation system. _____
33. Include movable and folding partitions, power-operated and controlled by key switches. _____
34. Include wall plates located where needed and firmly attached. _____
35. Include hooks and rings for nets placed (and recessed in walls) according to court locations and net heights. _____

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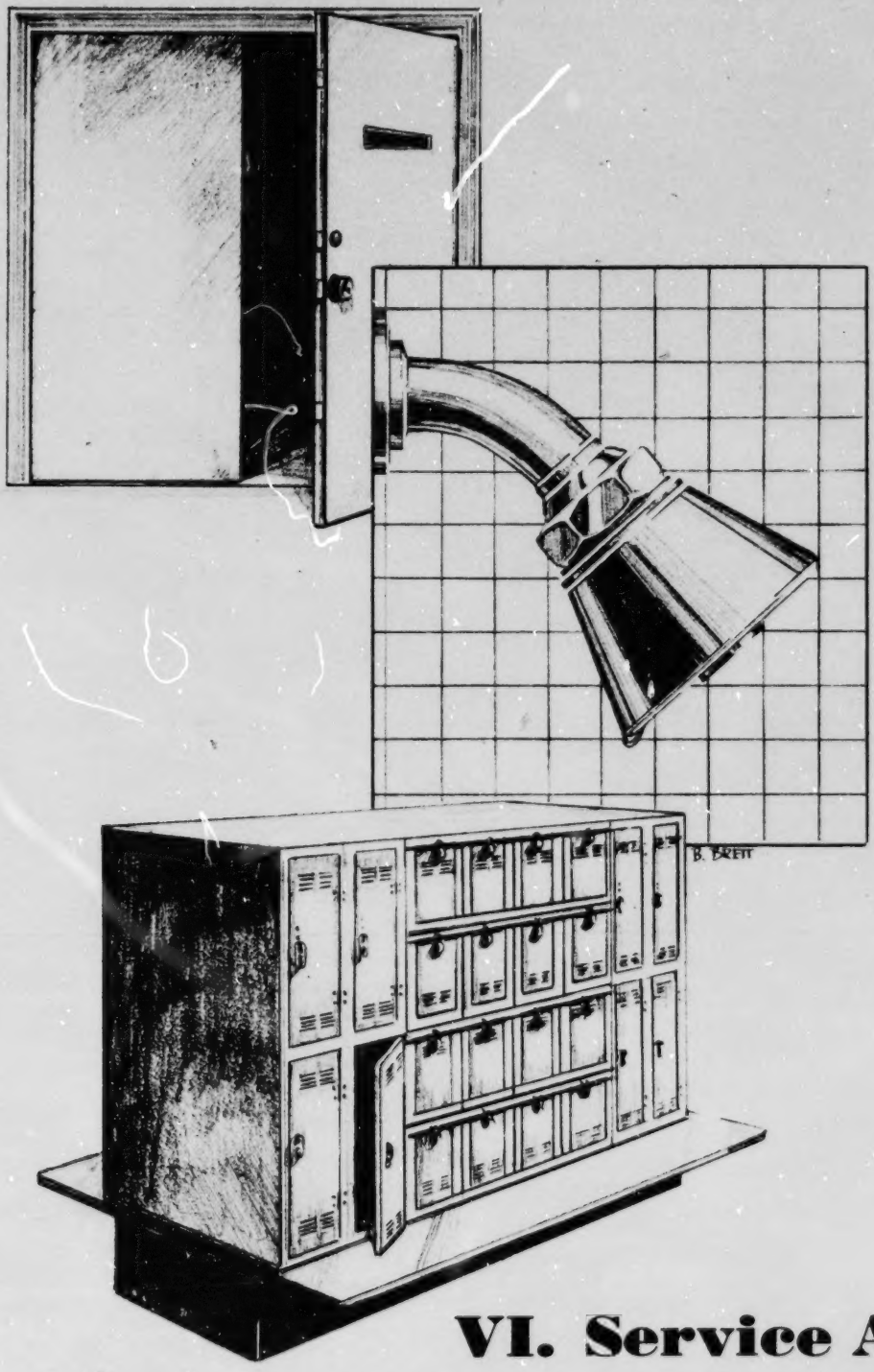


VI. Service Areas

Service Areas

FEDERAL REGULATIONS relating to equal opportunities for men and women have created a significant increase in need for service facilities to support new programs—particularly competitive athletics. Planners need to project service facility needs carefully for women's sport teams. Failure to include additional space needs (at least in a master plan) can be very costly because of the unique problems and the great expense associated with locker area construction.

Planning must include joint use by men and women as much as possible. Storage rooms, equipment issue, conditioning and athletic training rooms, and laundry facilities should be planned for such use. The recommendations in this chapter are predicated on the provision of equal opportunities for men and women.

Effective planning of the various service areas in activity centers is vital to the efficient use of the building. The location of the respective facilities should result in easy, direct traffic patterns for participants, instructors, and custodial employees. The selection of proper space design and operational systems can result in future years of efficient administration at minimal expense.

THE DRESSING LOCKER ROOM

Location

Perhaps the most important aspect of location is accessibility. The locker room should be located to serve the indoor and outdoor teaching stations and other service facilities requiring dressing space. The dressing room should be immediately accessible from corridors. Planning for several corridors leading to these areas will reduce overcrowding during class changes.

Ideally, the dressing room should be on the same floor as the gynmasium and the swimming pool when a common level is used for both stations. This will alleviate traffic congestion and possible injuries resulting from movement up and down stairways. Local architectural problems may make this location impractical.

It is desirable that the dressing room have direct access to outdoor recreational areas and indoor teaching stations without requiring individuals to cross main corridors. As students return from outside activities they should have access to an area equipped with special drains and a mud crock for cleaning purposes. When the swimming pool adjoins the locker room, participants should be required to pass from the dressing area through the shower to the pool for hygienic reasons. In some designs, it is desirable that a separate dressing room be located at the pool area. This is particularly true if a pool is used extensively by community and after-hour groups.

Other considerations for dressing/locker room locations are in relation to shower, toilet facilities, equipment issue rooms, and instructors' offices.

Locker Room Size

The size of the dressing/locker room is based on a number of considerations. The locker system and the method of distributing towels, uniforms, and equipment affect size demands. Of particular importance is the number of individuals using the area at peak load. If there is an overlap of classes or simultaneous use by athletics, physical education, and intramurals the room must be large enough to accommodate this traffic flow without confusion. A general rule of thumb recommends a minimum of 20 square feet per person. A carefully drawn, preliminary scaled plan to include the locker placement, visual barriers, and accessories is the only acceptable way to provide sufficient space allocation. Additional space should be allowed if faculty, graduate assistants, and intramural and sports clubs must also use this facility.

Physical Features

Doors

Placement of doors for dressing rooms should facilitate a smooth traffic flow. In locker rooms that have many participants arriving and departing simultaneously, it is wise to provide for an entrance and a separate exit to a common passageway in order to eliminate a hazardous condition. All doors should be of heavy-duty, moisture-resistant material and should open to form a natural sight barrier. Doors should be placed in such a position as to offer protection to individuals who move through a main adjoining corridor. Outside doors from the locker room should be equipped with panic bars of noncorrosive metal.

Walls

Walls should be of a moisture-resistant material, easy to clean, and finished in a pleasing, light color. All corners in locker rooms should be rounded, and the junction of the wall to the floor should be covered for ease of cleaning and prevention of injuries. There are many materials including tile, plastics and other synthetics which are durable and easy to clean.

Floors

Floors should be of nonskid, impervious materials with a carborundum impregnated surface such as ceramic or quarry tile. If tile is used it should be small sized, about 1" x 1", so that it offers a non-skid surface. Concrete floors with nonskid surfaces should be treated with a hardener to prevent penetration of moisture and odors. Terrazzo, while offering excellent hygienic advantages, is too slippery for the average locker room. The same holds true for vinyl or asphalt tile.

Floors should slope toward drains. Recessed bibbs provide for easy cleaning of floors.

Synthetic carpeting, laid directly over concrete, is becoming very popular for locker room use. It is aesthetically pleasing, affords excellent footing and reduces noise to a minimum. Another advantage is that the floor need not slope since it is not hosed down for cleaning. Repairs can be made easily. The maintenance cost for carpeting is greater since regular vacuuming and periodic shampooing are required. However, in well-supervised areas, the carpeted locker room offers unique advantages. One disadvantage of carpeting is that moisture remains in the carpet and odors may persist. Keeping carpet away from wet areas will alleviate this problem. Other synthetics may also be used for the same reasons that carpet may be desired.

Locker bases, 8 inches to 16 inches high, should be of the same material as the floor and coved at the base.

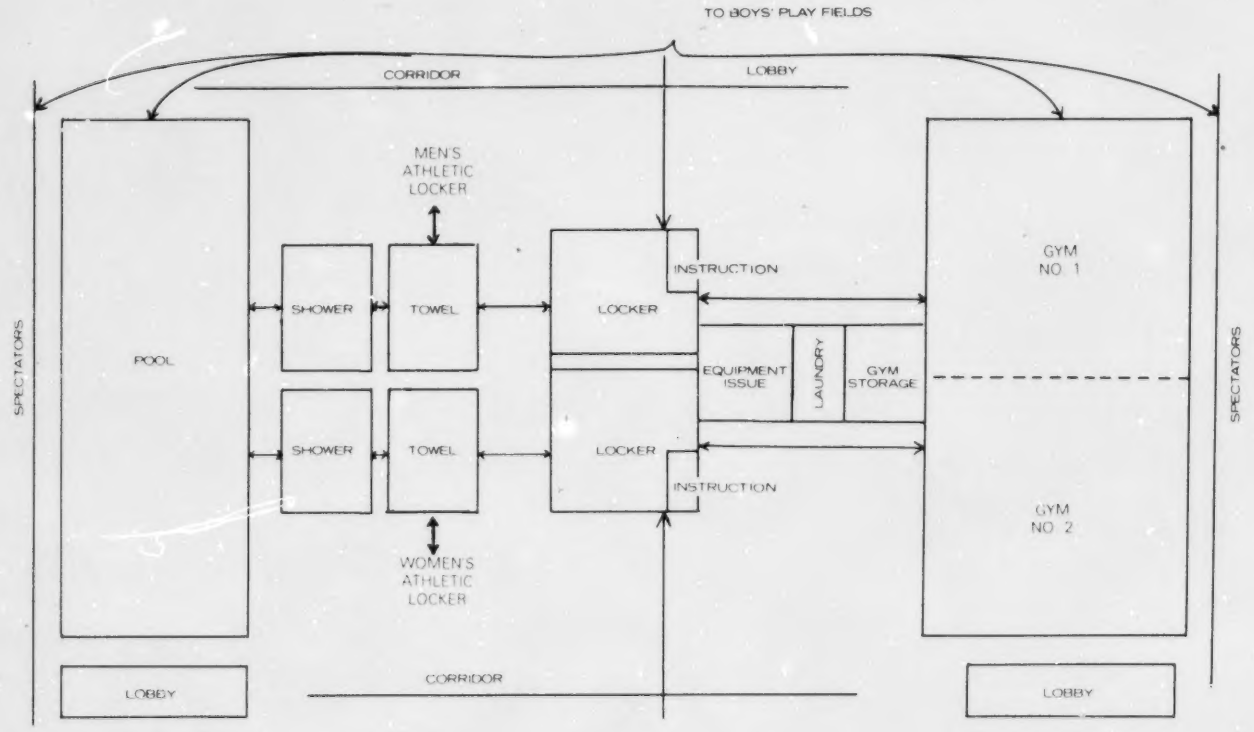
Ceilings and Lights

Ceilings, of a light color, should be acoustically treated with a material impervious to moisture.

The lights should have vapor-proof fixtures and be centered directly over the locker aisles for maximum efficiency. Electric outlets (including 3 prong units) should be approximately 3 feet above floor level. Emergency lighting should be available at all times.

Sidewall windows should be no larger than 24 inches in height, with the lowest point of the window at a minimum of 36 inches from the ceiling. This provides maximum privacy and allows the lower portion of the walls to be used for other services or an additional bank of lockers. If windows are

Figure 1
Location of lockers and showers



designed to operate for opening and closing, they should be controlled easily from the floor. In most instances, the ventilation system should eliminate the necessity of opening and closing windows. Windows of frosted, translucent material should be used to allow natural lighting to pass down locker aisles rather than against a bank of lockers. Placement and size of windows should be planned in conjunction with the entire locker arrangement and should not dictate or limit locker placement. It is recommended that glass not be used but one of the newer acrylic synthetics. These new unbreakable materials reduce vandalism and provide increased safety in the locker rooms. They can be purchased in a variety of finishes, thicknesses and colors.

Vented sky domes serve as an effective source of natural light. Although sky domes have been frequently a source of water leaks, new construction methods have reduced the hazards.

Accessories

Mirrors should be placed at strategic locations in the dressing room and vanity areas. Several full-length mirrors, placed at least 12 inches from the floor, should be available for individuals as they depart the room. They should be placed not only over the sink areas but in other locations as well.

Refrigerated drinking fountains of stainless steel or noncorrosive material should be located near traffic flow. They should be recessed or placed to protect the user from traffic movement.

Lack of hair-drying facililties often discourages maximum activity participation, particularly when inadequate time is provided to meet schedule commitments. Longer hair styles make such facilities as necessary for men as for women. Wall blowers—preferable with separate hoods, mounted at varying heights, and spaced at three to four foot intervals—are recommended. If the dressing room services are used by swimmers, one dryer for four or five men is sufficient. A ratio of 1 to 3 is needed for women.

Color

Adequate attention should be given to planning a total color scheme for the dressing facility. Locker rooms no longer need to be planned with an antiseptic appearance. A variety of locker colors, coordinated with decorated walls and carpeting, create a pleasing environment. Renovation or new construction should plan for the use of color to improve locker room aesthetics.

FACILITIES FOR LOCKERS AND SHOWERS

Supervision

In activity-oriented areas, supervision is of constant concern. Strategic placement of offices or service areas can facilitate administrative control.

The office of the teaching personnel is best located in an adjunct sector of the locker room. Direct access to the locker room from the office permits efficient performance of routine chores and consistent surveillance. Locating teachers and working personnel near the dressing room makes supervision an ongoing rather than piecemeal process. A see-through glass partition, or side windows on the wall facing the locker room, provide adequate sight for supervision. The office floor may be elevated to improve sight lines.

Another source of supervision is provided by placement of the equipment issue room or towel distribution center in a location that allows working personnel to observe activity in the room. Lockers should be placed perpendicular to the supervisory staff spaces for ease in observing locker aisles.

Security is also important and must be considered in planning. Expensive equipment and facilities need maximum security planning. Double security systems on main storage areas can aid in preventing vandalism. A new concept in security is an electrical system monitored in a central security office.

Shower Rooms

Location

Shower rooms should be centrally located in relation to the dressing rooms served. It is economical to provide a shower room that can service more than one area. However, it must be of adequate size to accommodate peak loads in all areas. The nature of the groups using the facility is an important consideration. For example, if a swimming pool will be used extensively by community groups, it may be advisable to build separate service facilities for the pool. Such exclusive facilities offer greater flexibility of programs along with improved supervision and security.

In general, lavatory, toilet, and shower facilities should be grouped in close proximity. Cost of installation is reduced since the amount of piping will be considerably lessened.

Shower Room Size

The size of the shower room is determined by the type of shower arrangement and the number of people served at a peak time. All individuals participating in instructional classes, intramurals, and athletic programs should have the opportunity to take showers. Since time for showering is usually limited to 10-12 minutes, a sufficient number of shower heads must be planned. Ten shower heads are recommended for the first 30 people and an additional shower head is recommended for every additional four persons.

Shower Installation

All types of shower installations should be studied and the selection made according to the advantages of a particular system for the situation at the individual institution. The center post system (Figure 4) provides for a grouping of shower heads on a single pole. This arrangement allows for the use of shower barriers rather than solid walls around the room and thus affords easy supervision. If this system is selected, the hardware and piping attached to the post at the base should be of a noncorrosive material and a maximum of four shower heads per post should be used.

Installations along the outside walls are the most economical in terms of space, since at least three full walls can be used for shower heads. It is absolutely necessary that provision be made to repair plumbing defects, by putting plumbing in pipe spaces and providing access from the back of the shower wall.

Overhead showering (the progressive walkthrough) installations are adequate for showering before swimming. However, the advent of longer hair styles makes this system unpopular except for swimming pools. Without close supervision it does not insure proper cleansing.

Shower Heads

The shower head should be selected after inspecting a number of features. The head should be self-cleaning and adjusted for fine spray. It is generally recommended that, when installed in buildings of institutional use, the angle of spray should not be adjustable. Spacing between shower heads should be two and one half feet for colleges. The height of the shower head should allow the spray to be directed at shoulder height, making it possible to keep the hair relatively dry if desired. Most shower rooms are used by various age groups in community programs, and it may be desirable to vary the height of a few of the shower heads. A master temperature control should prevent excessive water temperatures. Each shower head should have an individual control consisting of one hand control rather than separate hot and cold water controls.

Gang showers are most economical for men and women. Some showers should be located to provide for privacy. At least 10 per cent of the shower heads for women should be of individual booths close to the toweling room.

A liquid soap despensing system, if used, should be designed so that all piping is behind the shower room walls. This system should allow the custodial staff to refill the reservoir at a source away from the wet area. Recessed soap dishes, even if a liquid dispenser is installed, are recommended since many individuals prefer to use a particular bar soap or shampoo. Consideration must be given to the dangers of soap on wet floors and the use of glass shampoo bottles.

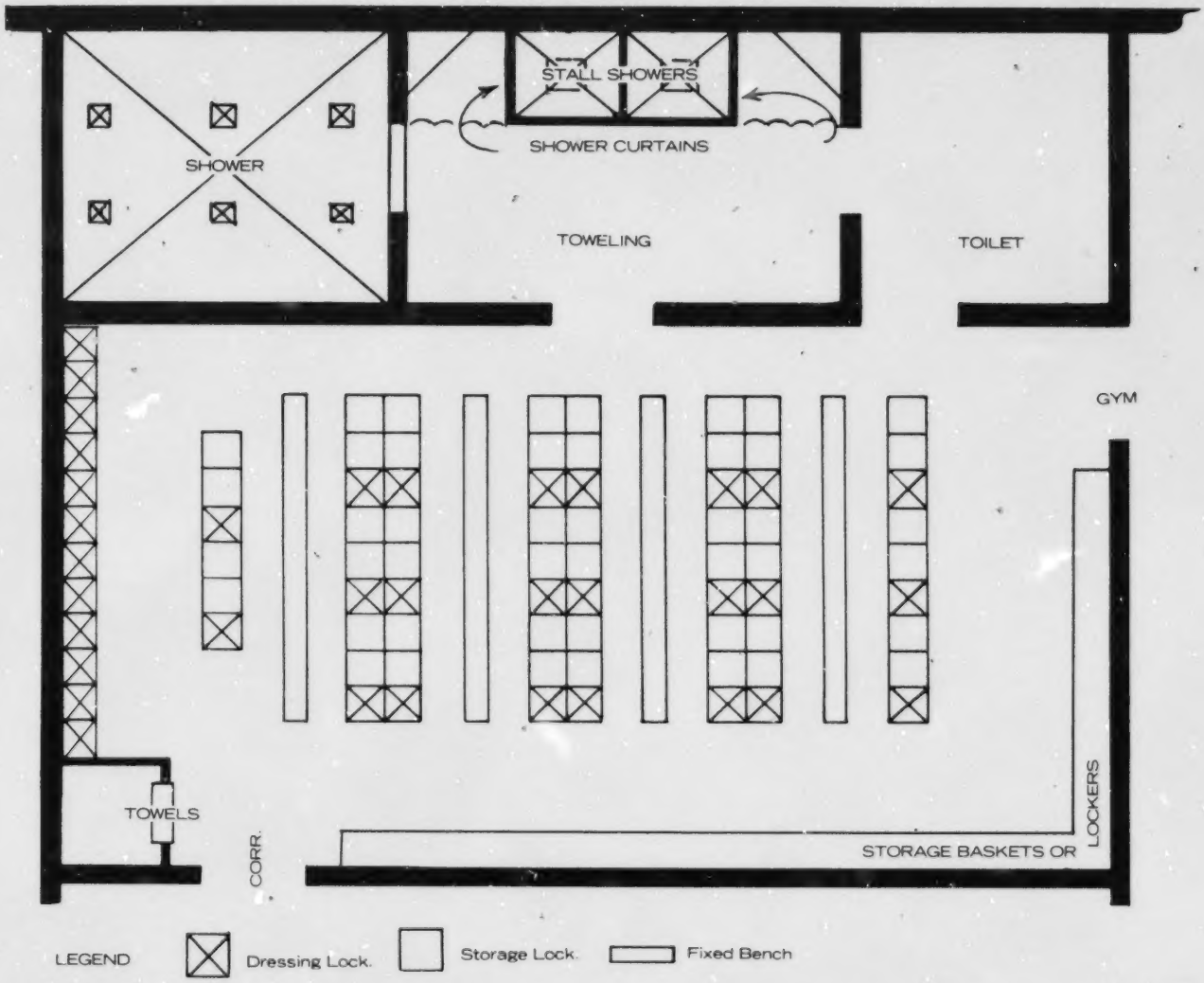
Doors

The opening to the shower room should be as wide as possible to allow freedom of movement in both direction. Openness facilitates supervision, and many shower rooms are being built with half walls or splash barriers for this purpose. A sloped surface may separate the shower and dressing room depending upon the locker room drainage system. A curb should not be employed since this creates a safety hazard.

Walls

The shower room walls should consist of a smooth and impervious material that can be cleaned easily. Builders should consider the use of glazed building blocks for the walls of these areas. Glazed block construction provides a surface

Figure 2
Combining open and private showers



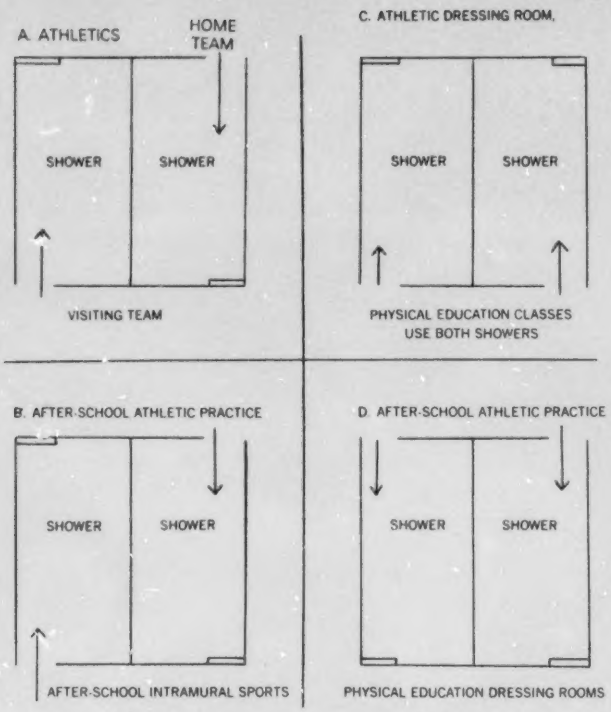


Figure 3
Suggested method of using flexible showers

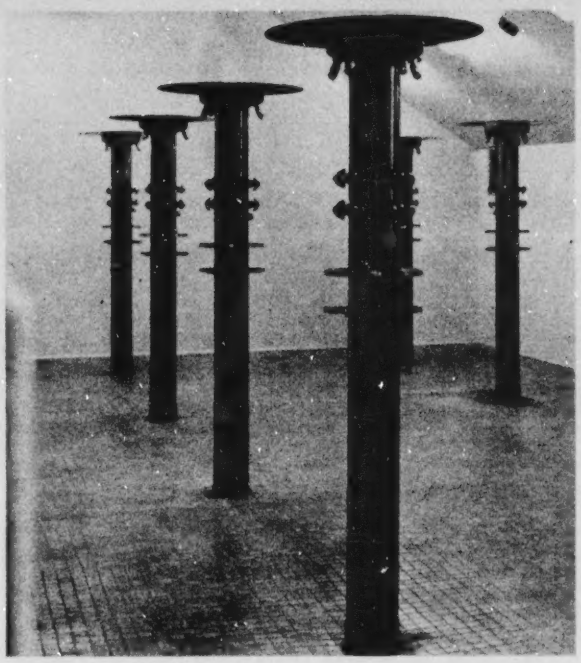


Figure 4
Shower Room, Schoolcraft Community College, Livonia, Mich., with stainless steel stands providing for liquid soap, soap dish and five shower heads per stand.

similar to tile but less expensive to install. It may be used in nonbearing walls only. Glazed block is suitable for low splash walls or dividers (See Figure 7).

Ceilings

Ceilings should be moisture-resistant, acoustically treated, and a minimum of nine feet in height. All lights should be recessed and vapor-proof, with switches located in dry areas.

Floors

Non-skid, ceramic tile or equal material should be used as the floor surface. The floor should be pitched away from the dressing room area and toward adequate-sized drains. The most desirable drainage system for shower rooms consists of tiled perimeter gutters directly beneath the shower heads leading to appropriately spaced drains. All gutter edges and floor and wall joints should be coved.

Hose bibbs, for cleaning purposes, should be located outside the shower room for safety.

Ventilation

A ventilation system is more economical and efficient if the shower room is located with at least one side on the outside building wall to allow ventilation and humidity control. It is essential to eliminate condensation, or maintenance becomes an expensive item.

Toweling Room

In general, the drying or toweling room should be comparable in size to the shower room in order to encourage complete drying in this area. This is particularly important when carpeting is planned for the dressing room.

The toweling room should be directly accessible to the shower and dressing rooms. The walls, floor, and ceiling should be of the same material and quality as the shower room. Floor edges should be coved. Normally, the walls need not be tiled beyond seven feet in height. (However, in most construction it may be more economical to tile to the ceiling). Noncorrosive towel racks should be attached securely to the walls. It is convenient to have the towel-issue room adjacent to, or near, the drying room. For sanitary and safety reasons, benches should not be installed in the toweling area.

Provisions should be made for drainage. A bull-nosed, non-skid, curb should separate the drying room from the locker room to protect against flooding.

Toilet and Lavatory

Strategic placement of toilet and lavatory areas facilitates traffic pattern controls. This is critical for spectator events. Each restroom should have individual forced air ventilation to the outside of the building at a rate of 30 changes per hour. Water closets, lavatories and urinals should be hung from the wall to facilitate cleaning. Special consideration should be given to the handicapped (See Figure 8). They should have a high standing water level. Individual stalls should be securely anchored to floors, ceilings, and walls. In locations where damage might be inflicted upon metal partitions it may be economical to use glazed brick or tile partitions. When soap dispensers are provided above lavatories they should be mounted in such ways that soap will not fall on the floor or on chromed fixtures. Paper towel dispensers are provided most frequently for hand drying and require disposal cans. Electric hand dryers are effective and more economical than paper. Paper towel dispensers and electric hand driers should be located away from the lavatories to prevent traffic congestion.

Mirrors should also be located away from the lavatories (A good location for mirrors in the locker room is at the ends of locker banks.) A shelf should be installed in school restrooms, outside the locker area, where students' books may be placed. In toilet areas for women, dispensers and disposers for sanitary supplies are needed. Waste disposals for all trash should be built in. Paper towels should be provided even when electric hand dryers are installed.

For the required number and type of plumbing fixture planners must review state standards, regulations, and building codes.

Lockers

The administrative and teaching personnel should be active participants in the selection of the locker system, since they are familiar with the problems of locker room administration.

The locker system and locker dimensions must be established prior to the determination of the room size. These, coupled with the plans for future expansion, should be the criteria in determining a functional lay-out and overall size for the locker room. It is recommended that the number of lockers should be equal to the peak load plus 10 to 15 per cent, with adequate allowance for overlapping classes, variations in class size, scheduling, and anticipated use by intramural, recreation, and athletic participants. Projected enrollment is another factor that must be considered.

There are several locker systems to be considered. Selection should be made after carefully considering the following requirements of any system:

- Security of street clothing and physical education equipment
- Efficient use of space and facilities
- Control of odors
- Efficient administration for student
- Administrative feasibility, including supervision and maintenance
- Economy of operation
- Flexibility for use by different groups

The Individual Dressing Locker

There is little doubt that the individual dressing locker best meets the needs of all participants. Costs in terms of space and initial investment make it impossible to provide this convenience for all users. Usually, such lockers are installed for athletes, coaches, teachers, game officials, professional major students, or the professional recreator.

The individual locker should be large enough to handle equipment for the sport requiring the maximum space (in most schools, football). If an equipment-drying room is available in which bulky equipment can be stored conveniently, the size of the lockers can be reduced.

Lockers with mesh sides and doors offer the best visual inspection and maximum control of odors. The antiquated "corridor locker" is no longer acceptable. The locker should have an upper shelf for such items as books, a low shelf for shoes, and adequate hangers.

Dressing Locker and Box Storage System

The dressing locker and box storage is the most common system for institutional use. Figures 9 and 10 show variations of this arrangement. A series of smaller lockers to hold all personal equipment is usually located near a large dressing locker. Only one box in a unit is assigned to a particular class. Therefore, during any given class, each member has the use of one large dressing locker, In some cases, storage lockers are located in a separate area and transported to individual lockers. This system is more cumbersome, although it does allow for special ventilation in the storage area. If the latter system is used, the uniform and towel issue rooms should be located between the two areas for convenience.

Basic Locker Room Systems

The basic locker room system concerns the physical layout, placement of the dressing and storage lockers, and their relation to the various service facilities. In selecting the desired size of specific lockers and determining the most appropriate locker system, a number of questions need to be considered:

- What equipment must the user store in storage lockers?
- What athletic equipment is provided and stored by the school?
- Are other lockers available to store needed equipment?
- Does the program require sweat suits and jackets for outside participation in cool seasons?
- Will the same locker be used for physical education and for an athletic team?
- Who provides the gym suit?
- Who provides the towel?
- Is a laundry system availabile—or planned?
- Will other groups—such as community recreation—be using the same locker facility?
- What personnel are available to administer a basket system?
- Is it feasible from a financial standpoint?

Maximum security requires that the padlock of the box locker be transported to the dressing locker when in use and all contents of the box locker be placed in the dressing locker. Adequate supervision and operating instructions must accompany this system.

Administrators have experimented with attaching permanent combination locks on box lockers to eliminate need for lock control. In most cases, this system has not been satisfactory and is not recommended since street clothes are not secure without an additional lock. The system also entails frequent changing of lock combinations when lockers are reassigned.

Color coding of lockers is a popular means of assigning lockers. It not only affords easy recognition, but assists in overall supervision and makes the locker room attractive.

The size of the box locker is important to the success of a program. The tendency is to purchase lockers in sizes too small for efficient use. All locker companies build box lockers in sizes to coordinate with the dressing lockers. The best source of information is literature distributed by the manufacturer's representatives.

Increased shelf space rather than height has been found to provide more efficient storage in lockers. However, the program dictates the need. If tennis racquets are not furnished, for example, the institution has an obligation to provide adequate storage space somewhere in the building. Similarly, programmers offering outside instruction in cool weather should reasonably expect to offer facilities that properly care for additional clothing.

For institutions that offer laundering of uniforms, the box locker plan, which can be serviced from the issue room by an attendant, has distinct advantages. This plan saves student time because uniforms can be laundered and replaced syste-

*Heights of Shower Heads and Mirrors**

Age Group	Grades	Mirror Height		Shower Height		Shower Valve Height
		Vertical Length	To Bottom of Mirror	Girls	Boys	
Elementary	2 thru 6	30″	32″	50″	55″	36″
Junior High	7 thru 9	30″	40″	54″	60″	40″
Senior High	10 thru 12	30″	44″	56″	66″	45″
Adults		30″	48″	60″	72″	48″

*Notes: 1. Mirror mounting heights apply only to mirrors of size listed. Smaller mirrors are not recommended.
2. Shower heights are for heads 8″ from wall. Height should be adjusted if closer to wall.
3. Girls shower heights are shoulder high.
4. Shower heights are from floor to face of shower head (not rough-in dimension).

matically by the staff. The system also utilizes space more economically. Daily changes of uniform reduce odors in the building. The operational costs of this system are obviously high because of increased labor costs for attendants (See Figure 11).

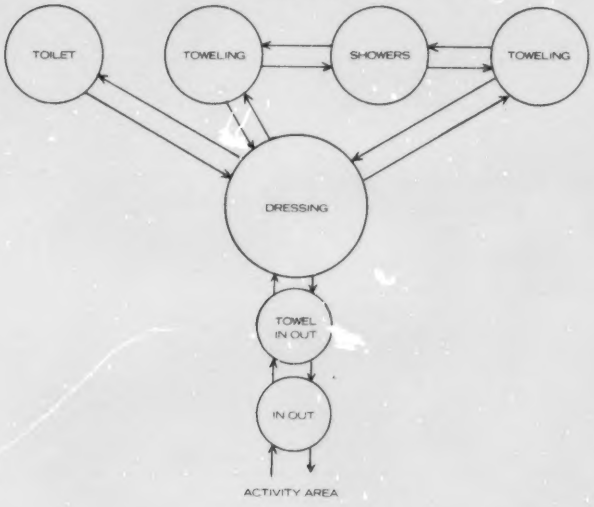
Tote Basket System

The tote basket system (Figure 12) has been used most frequently in elementary school or swimming pool areas. It is administered in several different ways. In some operations, the basket is stored inside a storage room and issued through windows. The student carries the basket to the locker room area. Obviously, this system requires attendants and breaks down when a large number of students arrive and depart simultaneously.

In another arrangement, baskets are stored on special racks in the locker room itself. A student is issued a padlock and has ready access to his equipment. This plan often results in pilfering, since it is very difficult to construct baskets and supporting racks that withstand deliberate attempts to damage through force. When overnight storage is needed in the locker room, storage lockers are preferred over baskets.

Another administrative plan for the tote basket system merits consideration. It allows for the storage of baskets on separate dollies for each class in a special security area. When the class arrives, the attendant rolls out the dolly and returns the baskets from the previous class to the secured area. In many situations, it is not necessary to put locks on individual lockers as long as adequate supervisory controls can be established.

Figure 5
Locker suite traffic flow



The main advantages of the tote bag system are:

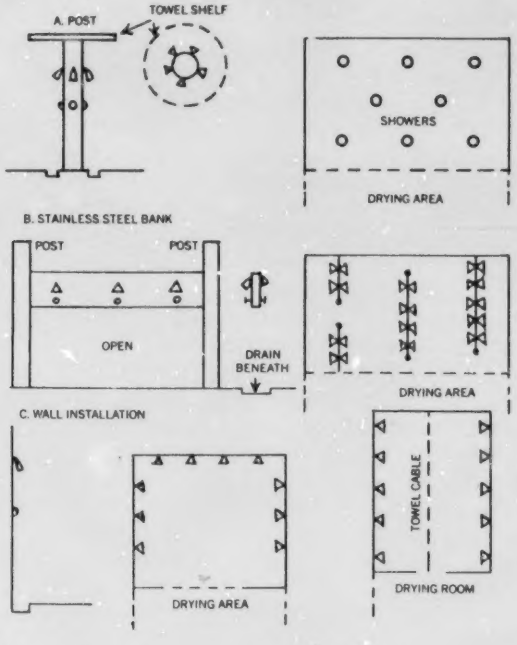
- A need for fewer standing lockers (wall hooks around the locker room perimeter may offer sufficient space for street clothes)
- Relatively good ventilation
- The economy of space.

The disadvantages of this system are:

- Fragility of baskets.
- Possibility of misplacing baskets.
- Need for greater supervision.

There is a growing tendency to replace this system in elementary schools. If school systems are to give more than lip service to the community-school concept, the school must be built to handle the unique problems that exist when community groups use facilities. A locker system instituted for reason of economy may not be used by the community when school is not in session.

Figure 6
Shower head arrangements



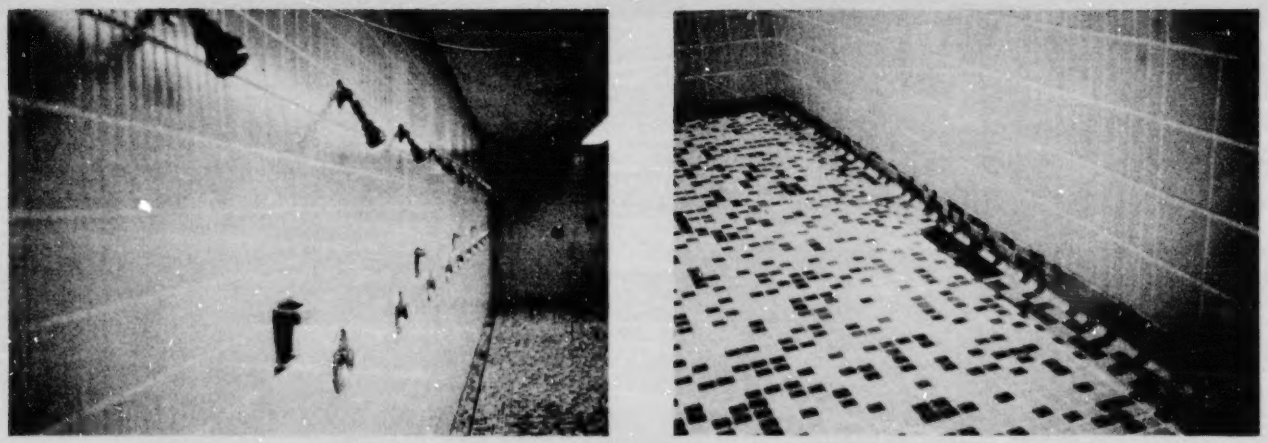


Figure 7
Shower room at the University of Windsor, Ontario, with tiled floor and wall, perimeter gutter, recessed single control spigots and movable shower heads.

Locker Construction

The proper selection of lockers is imperative. Equipment of this kind should be chosen according to the nature of the program and the usage it will receive. Failure to install quality materials can be costly. Specifications should be written after a thorough study of locker construction. Most locker manufacturers will provide literature.

Sturdy, heavy-gauge metals should be used. Lockers normally receive extensive use and must serve for many years. Steel sheets are manufactured in thicknesses varying from .1196 to .0239 inches. Thickness in inches is measured in gauges. Normally, the doors are of greater thickness than the sides and back. Special materials are used as needed at locker ends or exposed areas.

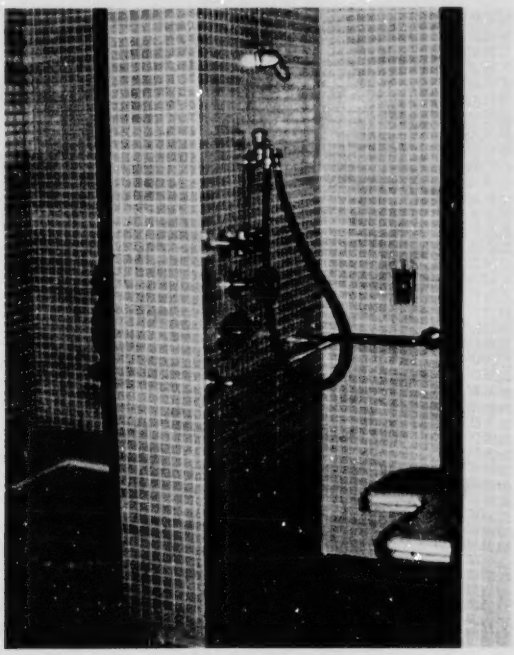
It is advantageous, in most instances, to purchase all-welded, factory-assembled units, which are more sturdy and permanent than units delivered ready for assembling at the site with nuts and bolts. Although initial costs and charges are higher for a pre-assembled unit, the savings are frequently lost in assembly costs and errors at the construction site.

A second consideration in locker selection is ventilation. Lockers with expanded mesh construction assure adequate circulation of air, speed drying, and reduce the growth of bacteria by the admission of light. There is general agreement that the locker room, itself, should be the drying room rather than a specially-constructed room. A total room ventilation system is preferred to a system internally installed in lockers.

A third consideration is the need for visual inspection. This is an item of local concern, but it can be an important function of administration.

Sloping tops have advantages in that dust cannot accumulate and they can be cleaned easily. Ventilation systems may be affected by the additional height necessary for sloping tops and this factor should be investigated before reaching a decision. On the other hand, when flat, lockers tops are low

Figure 8
Shower and lavatory facilities for the handicapped at the University of Illinois, Urbana, Ill.



139

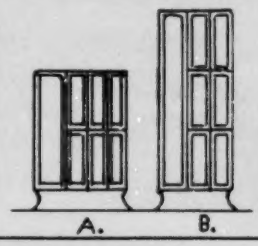
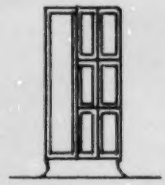
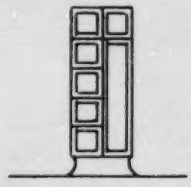
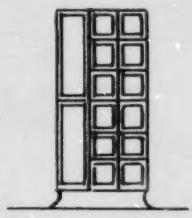
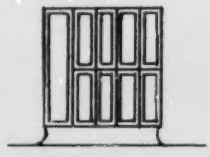
ADAPTATION	SIZE OF LOCKERS AND BATTERY ARRANGEMENT	ARRANGEMENT OF LOCKERS ONE PUPIL EACH PERIOD	OVER-ALL HEIGHT WITH 8" BASE	NUMBER STUDENTS PER DAY	AREA REQUIRED INCLUDES 4" FOR VENTILATION
6-PERIOD DAY	A. 6 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 48" B. 6 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 72"		A. 56" B. 80"	240	A. 152 SQ. FT. B. 115 SQ. FT.
6-PERIOD DAY	6 STORAGE 9" x 12" x 20" 1 DRESSING 12" x 12" x 60"		68"	240	115 SQ. FT.
6-PERIOD DAY	6 STORAGE 12" x 12" x 12" 1 DRESSING 12" x 12" x 48"		56"	240	93 SQ. FT.
6-PERIOD DAY	12 STORAGE 12" x 12" x 12" 2 DRESSING 12" x 12" x 36"		80"	240	133 SQ. FT.
7-8 PERIOD DAY	8 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 48"		56"	320	187 SQ. FT.
7-8 PERIOD DAY	8 STORAGE 12" x 12" x 12" 1 DRESSING 12" x 12" x 48"		56"	320	133 SQ. FT.

Figure 9
Typical combined storage-dressing locker arrangement

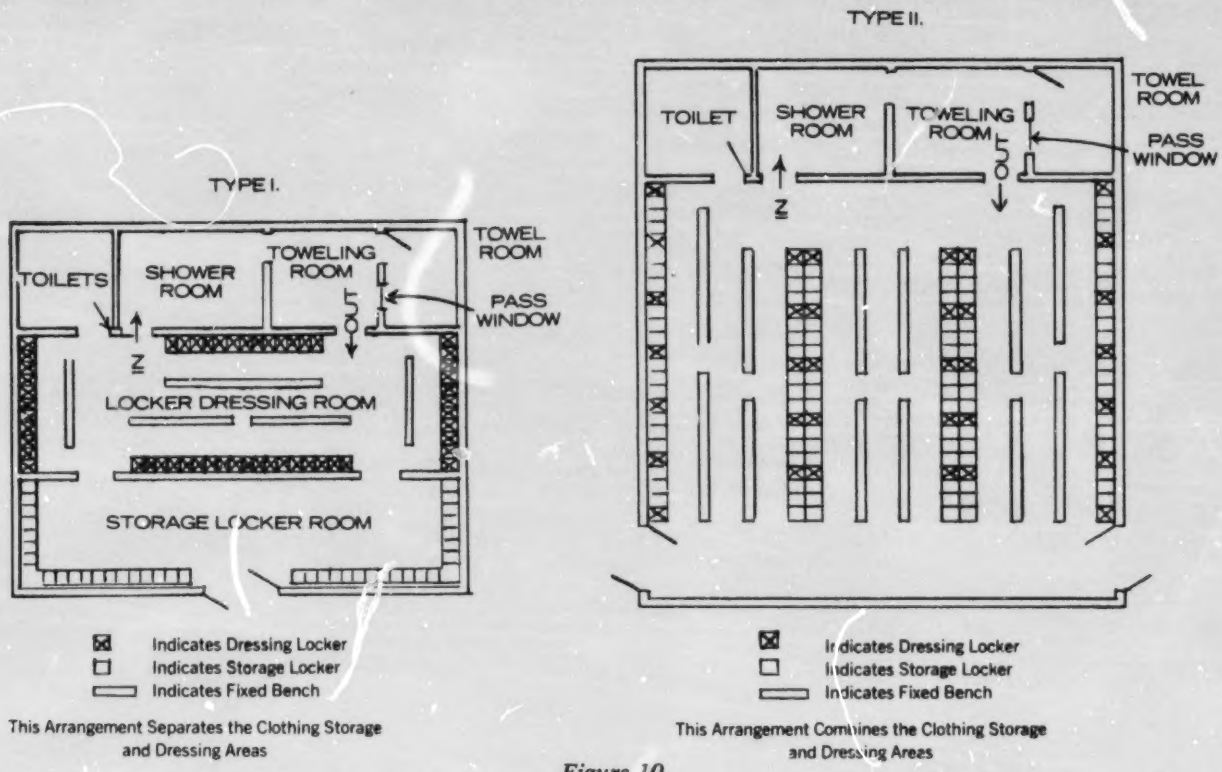


Figure 10
Illustrative arrangements for dressing locker and box storage

enough to allow frequent dusting, a flat surface does provide a convenient place for books while the locker is being opened.

The latching device for lockers should provide three-point latching — at the top, bottom, and door handle. Rod guides at the top and bottom give proper security.

When lockers are placed back to back, a 3" - 4" forced air space should be left between the rear panels for adequate ventilation. The bottom of the locker should be attached to an 8" - 16" base. This permits floor hosing and eliminates corrosion.

Benches should be secured to the floor with noncorrosive equipment. A fiberglass, plastic, or hard wood seat 8 inches wide, with rounded edges and a smooth surface, should be 16 inches from the floor. Space between lockers and benches should be planned for traffic control and dressing comfort (See Figure 13). The recommended allowances are 30 inches from locker to bench with an allowance of 8 inches for bench width. Benches should extend the full length of each locker bank, with breaks at intervals of 12 feet.

Lockers that provide a recess at the door lock to keep the padlock from projection to the aisle allow for easier passage.

There are a number of features that make a third arrangement very effective. The solid pedestal slab placed over the locker base, and extended out to form a bench on either side of the lockers, is being used frequently. This arrangement should be given serious study. The prime advantages are that the aisles are unobstructed, cleaning is simplified, safety is improved, and floor area is conserved. An alternative to this system has been used effectively and can result in a great savings of space. The plan depends on a condition which requires only one bench per aisle. Seldom does a locker room demand more. The pedestal slab is used alternately between rows of lockers so that only one pedestal bench is available for each aisle. This represents a saving of one square foot times the length of longer aisles for every two rows of lockers. (See the illustration concerning bench arrangements.)

The pedestal locker system, however, has its drawbacks. Since the bench slab should be 16 inches high, the lockers will extend 8 inches more than with the traditional 8-inch base. It is inconvenient for elementary school youngsters or short students to operate lock combinations on the top row of storage lockers. A 60-inch locker arrangement is recommended rather than 72 inches, if this style of bench is used. If 72-inch lockers are selected, the effects on lighting dispersion and room ventilation in a given situation should be analyzed, since the total locker bank height with a sloped top will exceed 8 feet.

Locker Sizes

Lockers and locker units are available in many sizes and combinations. They should be chosen after careful consideration of the needs. It is extravagant to provide more space than needed, but in most cases the lockers purchased are inadequate.

Typical combined storage-dressing room locker arrangements are usually selected according to the number of instructional periods available in a day. Frequent variations in lengths of periods and, therefore, changes in the number of periods per day, will upset a carefully planned locker system. Modular scheduling, split sessions, and independent course study also tend to disrupt the operation of a well-planned system. The choice of the system should be made only after thorough discussion with administrative personnel concerning future operational plans. (See Figures 14 and 15.)

Special Features of Elementary Locker Rooms

Elementary schools should plan for the construction of

Figure 11

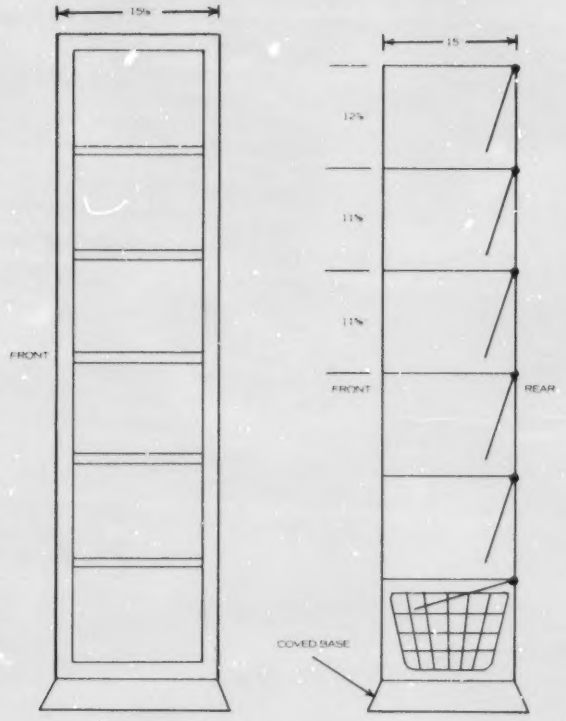
At the University of Windsor, attendant (left) services box locker from rear; participant (center) removes clean gear from locker; (right) he uses full length locker to secure gear.

locker facilities that allow pupils to change uniforms and shower. In these grades, teachers should control security. Baskets on dollies that can be moved to secure areas are adequate. Another acceptable system is a series of shelves of box lockers, secured by padlocked doors. The teacher need only open several locker doors for each class, and the pupils have no need to operate locks.

For the upper elementary students, wire mesh lockers of sufficient size to hold personal equipment should be available. If these lockers are purchased as a part of the system to include individual lockers, the large lockers serve a dual use for after-school activities. Failure to provide facilities of this nature will deprive school personnel from developing and planning a comprehensive program for the future.

Figure 12

Front and side view of post office box lockers showing doors, baskets and markers in the rear.



The locker-shower complex should contain sufficient individual lockers to encourage faculty to assist with after-school student acitvities and to be active for their own recreation. Adult education and community groups should have lockers and space available for night classes. It is recommended that at least 600 square feet be designed to accommodate adult use. The multi-use concept requires that serious consideration be given to planning an area in elementary school locker rooms that can be used by athletic teams in the district. A dramatic increase in the number of athletic offerings, including the resurgence of girls' interscholastic athletic teams, has created real problems in facility scheduling at the secondary schools. Efficiency can be increased if adequate dressing and locker facilities for designated school teams are planned as a part of the elementary complex.

The height, size, and amount of such service facilities as showers, urinals and drinking fountains should reflect the school-community philosophy and provide suitable units for all age groups.

The Athletic Team Locker Room

The development of diverse athletic teams and the tremendous growth in numbers of participants mandate special attention for team locker rooms. Frequently, planners fail to provide for the expansion of particular athletic programs and the introduction of new sports teams. As a school increases in population, a varsity football program may expand to include separate junior varsity and freshman teams. At the same time, the fall sports program may be broadened to include soccer, cross-country, and other teams. Growth may also take place in winter and spring programs and include the development of women's teams and intramurals (Figure 16).

A well-developed master plan will permit orderly expansion. The following recommendations should be considered:

Locker rooms should be planned so at least one wall is an outside wall of the building. If the construction plan is

designed to provide for future expansion, the addition can be put on at a future date.

The physical education locker arrangement can include team lockers interspersed throughout the room. A plan of this kind can allow one of the athletic teams — basketball, volleyball, golf, or wrestling — to use this dressing room without undue interference.

There is a trend toward providing separate, outside athletic locker rooms for sports such as football, soccer, baseball, track, and lacrosse (See Figure 17). The space under bleachers or in a separate building allows for excellent facilities. Planners should consider the following points:

- Cleaning costs are reduced because players do not go back into the school building with dirty, sweaty uniforms.
- Cleaning can be accomplished by hosing down.
- Construction can include cinder block to reduce cost.
- The cost of providing utilities at the site is decreased.
- Administration of the teams is improved because of separation.
- Participants in after-school programs can continue to use school facilities without interference.
- Outside facilities such as public toilets, ticket booths, and refreshment stands can easily be made a part of the total complex.
- Participants in community recreational programs can use the facilities.
- The locker room is easily accessible from the playing site.
- Visiting teams can use one of the locker rooms.

The development of a total complex for the team should include coaches' offices and dressing, locker, and toilet facilities for players, visiting team, officials, and coaches. A training room, equipment issue room, meeting or lecture room, storage facilities, and adequate ventilation system for drying clothes are other needs for these team locker areas.

Lockers should be of open mesh, with expanded or perforated metal. All team lockers should be from 60 to 72 inches in height and at least 12 inches in width (See Figure 18). If football equipment is stored in lockers, the lockers should be 18 inches wide. Serious consideration should be given to eliminating clothes lockers and providing proper hanging space and a small security locker for valuables in the football area. Ventilation, controlled automatically, involves the total area and assures proper drying. The administrative procedures must include proper identification of player equipment and security control to protect equipment from theft. Each of these arrangements can save valuable space by eliminating the need for a separate drying room.

Provisions should be made to separate the dressing areas of the various teams for security purposes. To ensure flexibility, partitions can be constructed of heavy, mesh screening.

The lecture room should be large enough to seat the members of a squad informally. It should include a bulletin board and chalk board and be equipped for such audio-visual equipment as films, overhead projector, and video-tape review.

Storage Rooms

Proper storage areas that serve the various teaching

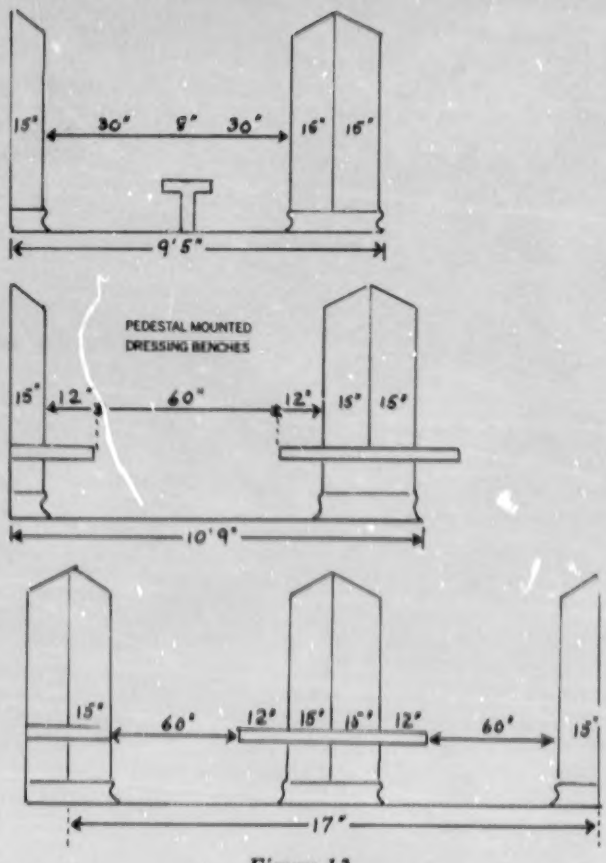


Figure 13
Dressing bench arrangements

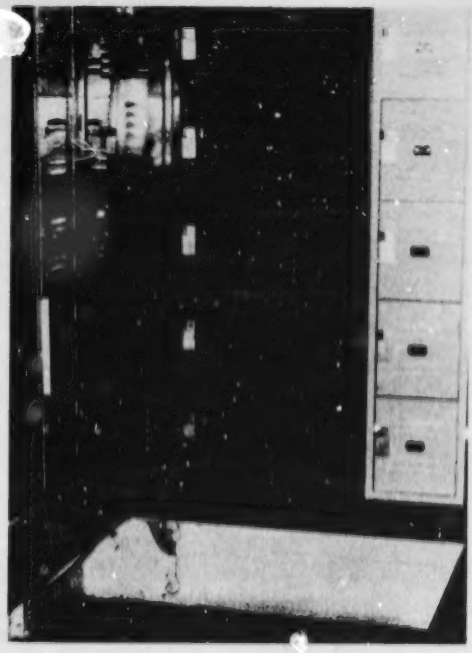


Figure 14
Combination system

Figure 15
Individual lockers and showers at Methuen (Mass.) High School

stations enhance the quality of programs. Over a period of years, a suitable storage system has significant economic advantages because of increased security and the proper care and maintenance of supplies and equipment. Staff planners must convince architectural designers that it is imperative to have adequate storage space.

Planners of any kind of storage area must be familiar with fire laws. For example, certain state fire laws do not permit storage under stairways unless the total construction is concrete and includes the installation of metal fire doors.

Several kinds of storage areas must be developed. In many cases it is possible to combine these areas efficiently. However, for purposes of identification, they are considered individually in the following sections.

Figure 16

Team locker room at Methuen High School

Supply-Issue Room

Adjoining the locker—dressing room, there should be a storage room for issuing physical education clothing and instructional equipment. It can also serve for towel issue and retrieval. Usually, a Dutch door or retractable metal partition is used.

Sufficient shelving and an efficient hanging system for special equipment must be included. A sturdy locking device to safeguard equipment is necessary.

Out-of-Season Storage and Repair

An equipment storage space for extra supplies and out-of-season equipment is best located immediately adjacent to the issue room, but separated by a solid wall with a door. A small area should be provided for equipment repair. This room should be organized for easy inventory and effective administration. Tilted shelves or noncorrosive bars are convenient for ball storage and other items. Installing these devices about an inch from the wall facilitates cleaning. Level shelves are needed to store most items. Bins are convenient for gymnasium equipment, hockey sticks, and baseball bats. Proper ventilation and humidity control are absolutely necessary for this room or supplies will deteriorate over a period of time.

Gymnasium Storage Room

This room should be located on the gymnasium level and be immediately adjacent to the teaching station. When partitions are used to divide the gymnasium into several stations, each station should have either a separate storage room or a separate opening to one large storage area.

Double doors with flush sills and sufficient height will facilitate movement of apparatus and equipment such as pinp-pong tables and tumbling mats. Invariably, these rooms are made smaller than necessary. Although a minimum area needed for storage of large equipment is recommended at 250 to 300 feet, extra precautions should be taken by the physical education personnel to attain sufficient space. The following procedure is recommended:

- Make a list of all equipment, including planned purchases, that need to be stored.
- Draw to scale, on graph paper, the storage space needs for each item and cut out templates.
- Arrange templates on scaled architect paper to indicate space needs.
- Present data to administrative personnel as verification of space needs.

In facilities that contain a separate gymnastics and tumbling room, apparatus can remain in that room when not used and eliminate storage needs. Selected activities that do not require a full teaching station can use that room when gymnastics classes are not conducted.

Some school systems transport gymnastics equipment from school to school to save duplication of purchases. Thus, a school retains the apparatus only while it is being used, and only one school of the group requires space for gymnastics equipment storage.

Figure 17
Worthington (Ohio) High School has separate building adjacent to fields for varsity locker rooms.

Figure 18
Otterbein College in Ohio uses wire mesh, sloping top lockers for its team locker room

Community Recreation Storage

The community recreational program requires storage space. The sharing of equipment and the misuse of equipment are frequent sources of contention between school and community groups. It is recommended that definite storage spaces be designated for the community program and adequate security measures be taken for both school and community equipment.

Audio-visual Equipment Storage

Effective use of audio-visual equipment mandates that accessible, well-protected, and secure areas be located at the instruction site. Video-tape and instant replay equipment are invaluable as teaching aids. In order to reduce damage due to mishandling, a small secure area should be available in which to store the equipment on a movable cart. The equipment can then be made readily operational.

There also is need for one audio-vidual equipment storage room accessible from the administrative areas. This can be used as a master storage area for audio-visual equipment and auxiliary supplies.

Outside Field Storage

If the main building is used for storage of outdoor equipment, the storage room should be located near the field exits. Such equipment would include archery targets, line-markers, bases, football charging sleds, tools, and the like. It is preferable to store these materials away from the main building and near the play areas, to prevent dirt from being tracked into the school and to allow easy access to the equipment. A building designed as a separate athletic team locker room affords an excellent space. Small outside sheds are frequently used, but they are subject to vandalism unless they are well-constructed and have a good locking device.

Athletic Team Storage Room

For purposes of control and accountability, storage rooms for athletic teams should be separated from those for other activities. Preferably, they should be adjacent to the team locker room for orderly issue of equipment. Shelving that allows easy categorizing of sizes should be provided. Open-end cubicles facilitate the storage of bulky items and provide for free circulation of air (See Figure 19).

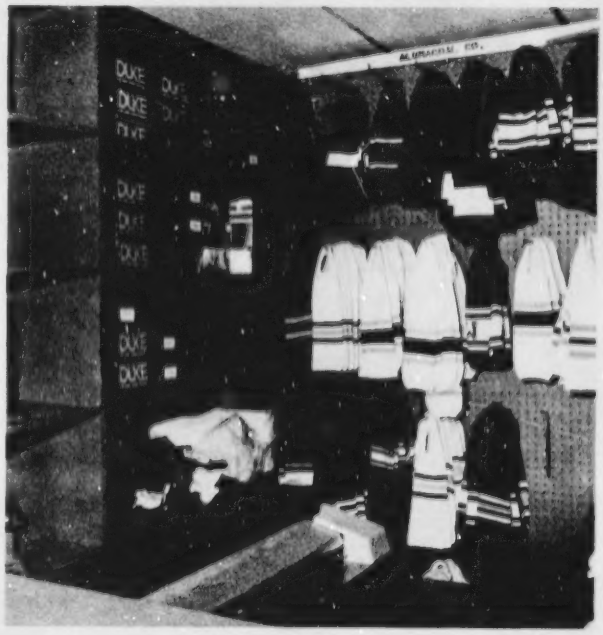


Figure 19
Storage area for athletic equipment at Methuen (Mass.) High School

145

Cedar-lined closets serve to safeguard woolen goods. Tables are needed to fold clothes prior to distribution. A work area for the repair of equipment should be nearby.

Controlled ventilation, temperature, and humidity are necessary to prevent deterioration of clothing, leather, and rubber goods.

Storage space must have maximum security. It is advisable to make provision for segmenting the shelves for respective teams with heavy wire-mesh screening.

Issue, inventory, and retrieval of uniforms is a function of the storage complex. The most convenient location for the issue room is immediately accessible to the locker room and separated from the storage room. Laundry may also be distributed from the issue room.

Custodial Areas

Custodial storage rooms should be located conveniently on each floor in each building. There should be at least one 6 foot by 8 foot custodial room for each 10,000 feet of floor space. And at least one on each floor. Each room should have a slap sink with a pop-up drain and a mixer-type faucet. Shelves and hanging boards should be constructed in each room for storage of supplies and tools.

A small room about 6 feet by 8 feet should be provided near the service entrance of each building for storage of tools and supplies used in building maintenance within the building.

Laundry

If a healthful school environment is one of the requisites of the educational program, laundry facilities for physical education and athletic programs should be promoted. Reduction of illnesses and skin infections, minimizing odors, improved appearance of uniforms, and a general attitude toward cleanliness are all benefits of a laundry. A well-administered system can lower laundry costs, reduce inventory, reduce losses due to theft, and provide general economic advantages to students and administration.

The decision to institute a laundry involves a complete feasibility study to determine if it is more economical than contracting with commercial companies. Renovation of old buildings is costly because of the need for extensive installation of heavy-duty utilities and the special features needed for room construction. A cost analysis should include such factors as personnel, equipment, building maintenance and use, utilities, supplies, and deliveries.

Location

The laundry room should be directly located off a corridor and preferably near the locker room area. Installation costs can be minimized if the laundry is situated near the shower and toilet facilities. The room should have direct access to a service roadway for transporting laundry to and from areas located away from the main site. Ramps should be installed if laundry dollies are to be transported from different floor levels. Provision must be made for adequate security of the area.

Size

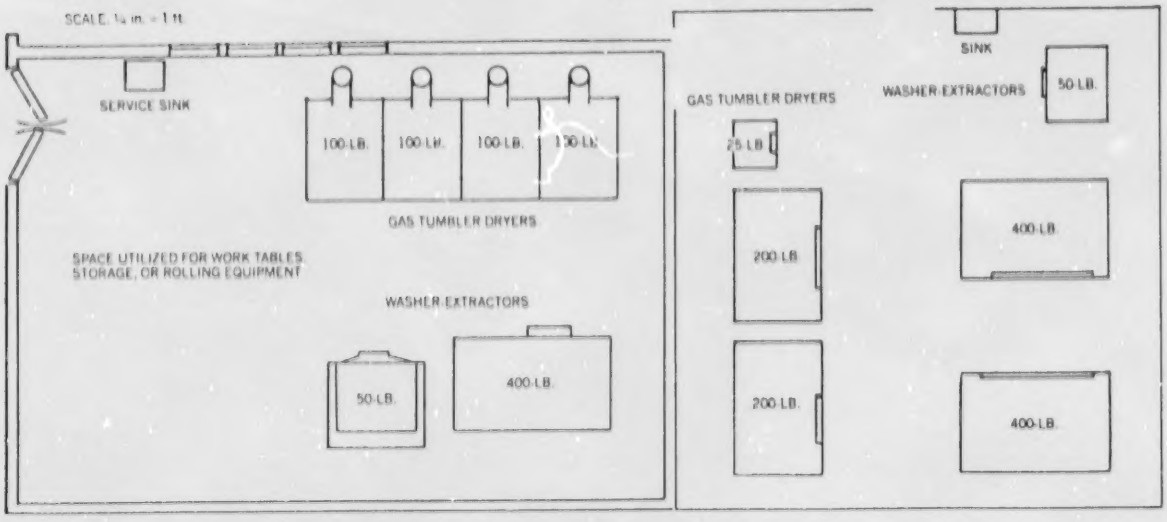
The total size of a laundry room is dependent primarily upon the quantity of laundry to be handled and the number and kind of machines to be installed. There must also be adequate space to perform routine related tasks. Storage shelves for clothes and supplies, space for laundry dollies, tables for folding and ironing, and a work space for issuing clothing and for general organizational purposes must be planned as additional features of the room. Adequate room for maintenance and repair should be left near the machines.

Equipment

Selection of equipment should precede architectural planning. Decisions relating to equipment purchase merit careful deliberation. Literature from the various manufacturers describes special features and should be compared closely.

The size of the machines depends upon the size of peak loads. It is worth investigating the purchase of several machines of different sizes, instead of one large machine to wash all items. Delicate fabrics can usually be handled in the smaller machines, and at least one of the machines is available to handle all of the work in the event that repairs must be made on others.

Figure 20
Suggested laundry room layout



Investigation should be made concerning purchase of the combination washer/extractor or separate machines. The combination has advantages for institutional use since it allows for a greater load to be handled in a given period of time. It also requires less space, less employee time, and less capital outlay.

The selection of dryers requires close investigation of the various machines manufactured. A series of dryers is preferable over one large dryer for most institutions. Preference for gas, electric, or steam must be decided on a local basis according to costs in terms of money and personnel. The same is true of the special features offered by various companies.

There should be at least a minimum ironing service available. Modern fabrics have eliminated the need to iron athletic uniforms, but on special occasions some ironing service will be necessary.

A sink should be installed for items requiring special care for stain removal or special rinsing.

Physical Features

Walls

Room construction should permit the laundry room to operate functionally and efficiently with minimal maintenance cost. The side walls should be soundproof, to prevent the noise of the machines from disturbing nearby school activities. In addition, some of the walls should be clear of obstacles or windows to allow for well-organized shelving spaces. Space should be provided for storage of laundry room supplies as well as for systematic storage of clothing or uniforms by sizes.

Doorways must be of sufficient size to permit replacement of machinery. Swinging doors with protective guards attached at the bottom are recommended. Flush sills allow laundry trucks to move in and out freely.

Ceilings and Lights

Ceilings should be moisture-resistant because of the high humidity. Acoustic treatment will reduce noise transmission to upper levels. Beams should be of sufficient strength to assist movement of machinery with pulleys.

Lights should be vaporized and furnish 50 footcandles of illumination throughout the room.

Floors

Floors should be sloped to drains. They should have a moisture-proof, nonskid surface that is resistant to detergents and bleaching materials. Sufficient space should be maintained between work areas to allow for efficient work patterns.

The floor should be durable enough to withstand considerable vibration and weight. Most machine manufacturers specify the construction of elevated, concrete bases for the installation of machines. In some instances shock-absorbing features are built into the machines and eliminate the need for bases.

Utilities

The heavy demands of laundry equipment require close conformity to manufacturers' recommendations on utilities. Laundry equipment should be selected prior to pipe installations.

Institutional machines use large amounts of hot and cold water. Steam must also be available. Machines must allow regulation of water temperature for various fabrics.

Provisions must be made for both 220 and 110 volt outlets. Manufacturers' specifications should be followed to prevent overloading. Sufficient outlets for auxiliary use should be spaced throughout the room.

Control of heat and humidity is always a problem unless adequate provision has been made to control climate. A location in the building that allows for good exhaust ventilation is an economical asset.

Training Rooms

In the planning of training rooms, the director of the sports medicine staff or head trainer should be consulted throughout the process. Proper consultation with experienced trainers is a must for every planning committee.

The size of the room needed depends on a number of factors such as the number of individuals it must serve, availability of assistant trainers, and the treatment areas contemplated.

Some universities with large athletic departments have training rooms in as many as five or six buildings. A central training area will have offices for the sports medicine staff during the morning hours, and later, during athletic practice times, the staff is assigned to auxiliary training rooms in the other buildings.

There is a growing trend for more and better equipped training rooms in our nation's schools. Many secondary schools have a designated Athletic Trainer, and this individual is on duty at practice sessions and all scheduled athletic events. College and universities with teacher-training opportunities offer degrees with athletic training options or as a major course of study and provide field experiences for them.

Location

Training rooms should be accessible to both men and women and located adjacent to their respective locker and shower rooms. There should be easy access to the area by ambulance service. In some universities and colleges the sports medicine staff also supervises rehabilitation of injured athletes and usually the rehab area is adjacent to the main training facility and offices. In this way constant supervision of this area can be maintained.

Physical Features

The floor of training rooms should be constructed of concrete and covered with vinyl tile, or one of the suitable synthetic materials. This facilitates easy cleaning. The training facility will be subjected to moisture, and therefore, the floor construction should be of a non-slip type of surfacing.

The first five feet of wall space should be constructed of easily cleaned building material such as tile, vinyl coated wallboard, or epoxy painted concrete block. The remaining wall space can be painted with a moisture-proof paint.

The ceiling should be at least 10 feet high, and constructed of acoustic tile or equivalent. This height will allow athletes to stand on a table for strapping.

Lighting should consist of at least 50 foot candles at a height of 4 feet. Because of the energy crisis which we all face in the coming years, efficient fluorescent type lighting should be used. Reflective coverings on walls promotes adequate lighting. Sufficient wall plugs of both 110 volts and 220 volts

should be located at appropriate areas around the room, not more than 2 feet from the floor. Make sure that all switches and terminals are properly grounded. Ground fault interrupts (GFI) must be mandatory in all hydrotherapy areas.

Proper ventilation is of importance to any area of a building, but of particular importance to the training room. Steam and moisture from hydrotherapy areas and heat from other apparatus can make this room very uncomfortable without well planned ventilation. The room should have its own thermostat because of the minimal clothing worn by the athletes. The total room should be color-coordinated with colors that are pleasing to the eye and constitute a relaxed atmosphere. The walls might be decorated with pictures of recent outstanding athletes and teams. Also a large bulletin board should be provided.

Layout

Most modern main training rooms are laid out with six areas in mind: (1) the general first aid and taping area, (2) hydrotherapy area, (3) electrotherapy area (Figure 21), (4) rehabilitation area, (5) athletic trainer's office and physician's examining room, and (6) a good-sized storage room.

Traffic control is important for efficient use of these areas. The placement of most frequently used areas should be close to the entrance. First, the taping tables; second, the electrotherapy section; and third, the hydrotherapy section. The rehab area may have another entrance (Figures 22 and 23).

Equipment

The equipment needed for each area of the training room will depend on the availability of space, the number of trainers employed and the size of the athletic program.

In the taping area of a large central training room at least 6-8 taping tables are needed approximately 42 inches high. They should have foam padding and be covered with a tough vinyl-coated fabric. A small shelf can be constructed at the one end of each table to accommodate storage of tape, gauze, etc. Ankle wrap rolls should be accessible to each table. Also a freezer should be located in this section. A new trend for saving space allows for one long taping table that should accommodate 8-10 athletes at one time.

The hydrotherapy section should be enclosed by a 40" - 48" high wall, so that water which occasionally overflows from the equipment can be contained. The floor should be constructed of non-skid tile and the floor should slope toward the drain. Whirlpools which use both hot and cold water, and the ice-making machine are kept in this enclosure. The proper electrical outlets and plumbing hook-ups must be provided.

The electrotherapy section should have treatment tables of similar construction to the taping table, but with a minimum length of 6' to allow an individual to layout full length. Electrical outlets should be planned for each table of sufficient voltage to accommodate electrotherapy equipment. Outlets should be 2 feet off floor so that arms, legs and backs will not accidently come in contact with receptacles.

The rehabilitation section should have a synthetic floor, because of the constant use of weights for conditioning. The type of equipment needed will depend on size of the school's program and the academic training of the trainers.

Trainer Offices and Physical Examining Room

The trainer offices should have partial glass walls for a view of treatment areas. Other equipment would include desk and chairs, a bookcase, filing cabinets, and a bulletin board. Each office should have a phone.

The physician's examining room should be completely enclosed and include an adjustable examining table, secure medicine cabinet, and small desk with chair. An adjustable surgical lamp might be installed.

Storage Section

A storage area adjacent to the training room is needed. This room should be large enough to accommodate supplies that will be used during the year. The area should have climate control and a heavy locking door.

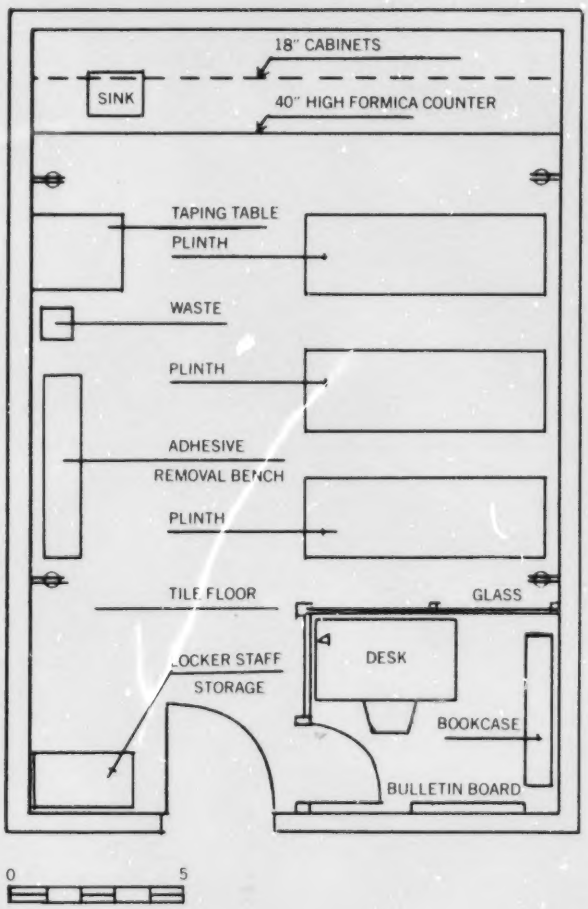
Facilities For Faculty And Staff

Administrative Units

Well-planned and effectively designed office suites and work rooms facilitate a smooth working relationship among the various divisions and enhance the success of the program. Staff members develop increased morale and motivation, which foster increased productivity, when office spaces and service areas provide a pleasant environment and a functional setting in which to work.

Planners can generalize about the relationship of the various spaces, but the unique problems of individual schools

Figure 23
Auxiliary training room



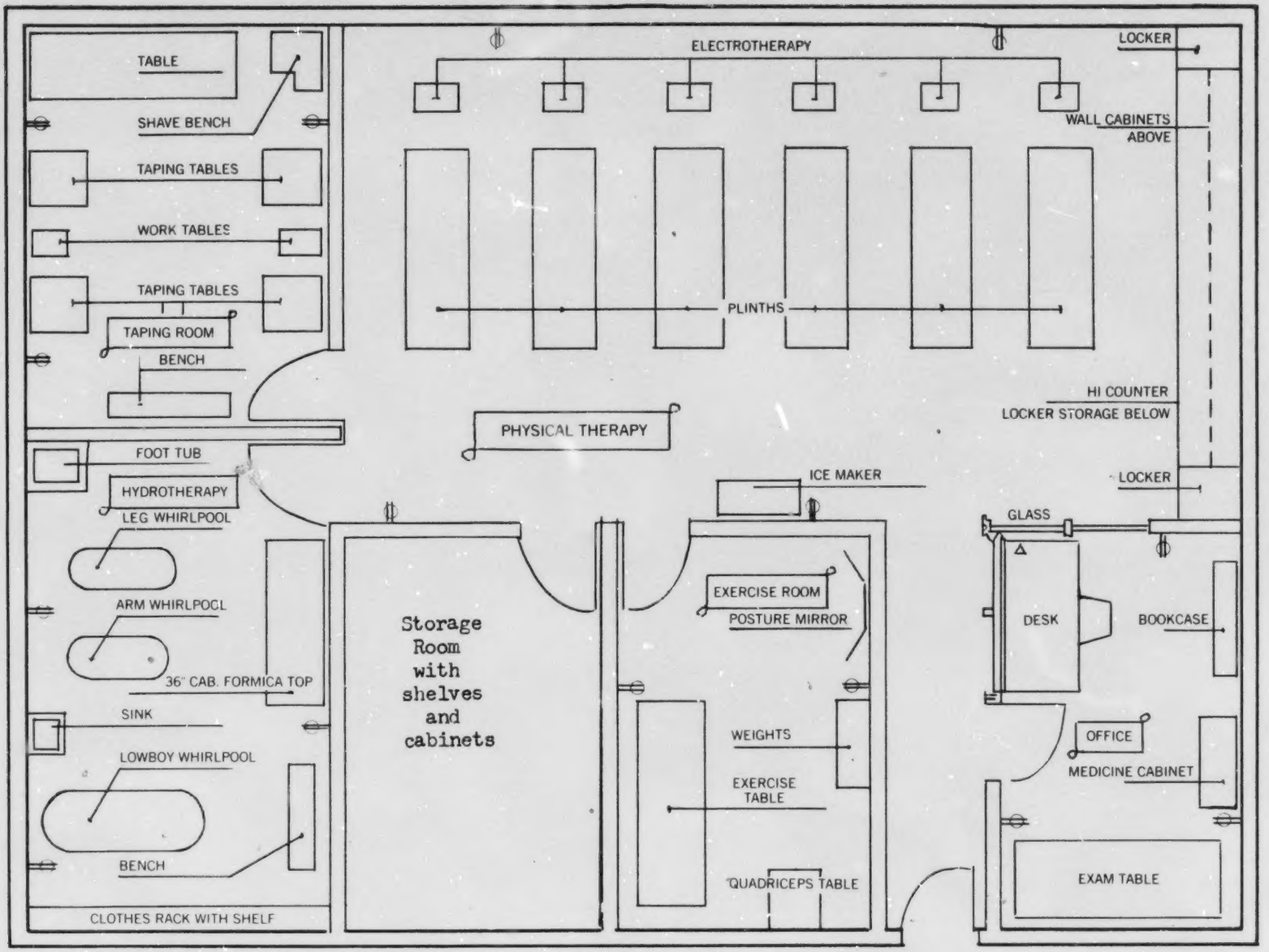


Figure 22
Central training area

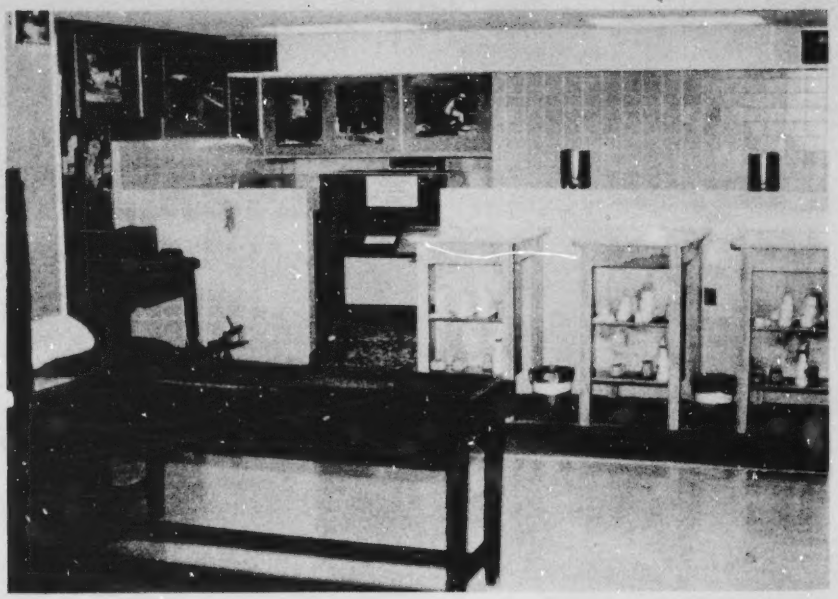


Figure 21
A section of training room at Michigan State University

make it difficult to establish hard rules. Planners should consider the following guidelines in relation to the special needs of the individual institution.

Centralization of faculty offices normally improves communication among the various departments. Working as a unifying group develops a valuable esprit de corps among faculty members. On the other hand, segregation tends to break down unity among groups. In larger colleges, the trend has been for athletic coaches and administration to locate apart from physical education. Since the athletic program is expansive, the separation allows for efficient athletic administration independent of physical education. However, over a period of time, with separation of personnel and subsequent changes in staff, a communication gap develops and little interaction takes place between two segments that normally require close coordination.

Planning committees need to weigh carefully the factors affecting administration prior to decentralizing a staff. At the same time, there are divisions that can function more efficiently if the staff is housed as a unit in a favorable location. It is recommended that staff members be grouped as working units according to their function but retain close proximity to other departmental personnel. Normally, the following units might comprise efficient working units:

Athletics
Intramurals
Teacher Education
Graduate Studies
Basic Instructional Program.

The trend is for basic institutional programs for men and women to merge into a single administrative unit. New and better coeducational programs are encouraged when the responsible individuals can discuss problems frequently. The location of facilities and congestion caused by large numbers of participating students bears heavily on the location of this area. Basic instructional programs involve the greatest number of staff and students and should be so located as not to interfere with other facets of administration.

Essential Administrative Facilities

Essential facilities related to administration include administrative and faculty offices, secretarial and clerical offices and workrooms, reception and waiting room, athletic offices, storage rooms, and faculty/staff shower and rest rooms.

Administrative Offices

Administrative offices should be located centrally in the building, with easy access from main entrances but apart from the noise and the main traffic flow. A reception area, controlled by secretarial assistants, should be available for guests and for scheduled appointments.

The administrator's office should have a minimum of 200 square feet. A large facility may contain a suite of offices for several administrators. These offices should be located close to the secretarial area but secluded from the normal routine of the day. Administrative offices should be provided with private toilet rooms.

The decor should produce pleasant working conditions and present a favorable impression upon visitors and guests. Consideration should be given to acoustics, including the transmission of sound through the walls and the sounds resulting from heating and cooling units. Carpeting and drapes are assets in these offices for improved acoustics, aesthetics, and morale.

Faculty Offices

Faculty offices should allow the staff to work comfortably. Particularly at the college level, many staff hours are spent in the office on tasks associated with teaching. Writing, planning, counseling, and routine administrative work are important facets of the job.

Office spaces should be large enough to accommodate the following items:

Large work desk with lock
Comfortable desk chair
Filing cabinet
Bookshelves
Side chair
Compact storage cabinet.

The private office is recommended and should be a minimum of 100 square feet. If rooms are larger, a common

practice is for a second person to be assigned to the office when additional staff is hired. The opportunity for each individual to work with maximum efficiency is thereby reduced.

Air-conditioning is recommended in warm climates if a summer program is conducted.

Secretarial and Clerical Offices

Planning for secretarial and clerical offices should include a job analysis for each position. Normally, secretaries are expected to perform, in varying degrees, the following duties:

- Act as receptionist for students, faculty, visitors, salesmen, press representatives, and others.
- Take and transcribe dictation, and perform a variety of typing chores.
- Receive and redirect telephone calls.
- Receive and distribute mail and other communications
- Answer written correspondence.
- Schedule appointments and keep track of faculty.
- Operate a variety of office machines, such as duplicators, mimeograph machines, ditto machines, and computers.
- File department papers, correspondence, forms, and other materials.
- Perform such business operations as bookkeeping and accounting.
- Prepare copies of class tests and other teaching materials as needed in courses.
- Dispense tickets for spectator events.

In small schools requiring one or two secretaries, a single main office usually suffices for all the tasks. At universities conducting extensive programs in physical education, recreation, and athletics it is preferred that secretaries be dispersed to various areas according to their functions.

Secretaries should be located in accessible areas, but in such a position that individuals do not pass in the immediate vicinity of the area unless business is to be conducted. Socializing with students must be discouraged.

If the reception room/office arrangement is used, the reception responsibilities often make it impossible to carry out the important tasks. Under this arrangement, if more than a single secretary is located in the office, it is best to use a system whereby a visual barrier will isolate those secretaries not serving as receptionists.

For each secretary, an operating space of at least 120 square feet should be planned exclusive of the reception and storage areas. Filing cabinets, desks, storage cabinets, typewriter space, and a work counter are the requisites for each secretary.

The telephone system should be convenient for all. The main telephone — containing all extension and intercom lines — should be at the receptionist's desk.

Easily accessible individual mailboxes should be located in the office. It is important that messages be readily seen and normal security be established for the mail.

A work room for carrying out routine clerical duties must be available. It contains copying machines with ample counter space to work efficiently. Metal shelving for paper and mimeograph supplies is required. Equipment for retaining and filing stencils should be placed in this room. If the work space for calculators and other office machines is not available in the main office, the work room should be used for this purpose. Rather than duplicate the purchase of costly machines, secretaries from various units, even though not located together, might use the same work room. The room should therefore be so located as to be accessible to the secretarial staffs of a number of units.

Audio-Visual Storage

Audio-visual equipment represents a large capital outlay and is subject to damage and theft if proper security is not provided. Videotape with instant playback, movie projectors, strip films, record players, and cameras are common equipment items. Additional supplies such as films, tapes, spare parts, and cords must be properly stored and inventoried.

It is recommended that secure storage areas be planned at the respective teaching stations for equipment normally used at the site. Such an arrangement encourages use of the teaching aids and reduces preparation time. However, in addition to these satellite areas, it is necessary to have a main audiovisual storage room with a good inventory and issue system and with one person responsible for security.

Schools expecting to use videotape and replay equipment need to establish several small areas in which staff and students may view and evaluate tapes or review tapes for preparation purposes. If normal classrooms are not available, a special room should allow several students to view tapes simultaneously. Methods teachers, student-teacher supervisors, and skill instructors have the most need for viewing films and should be consulted concerning needs.

Conference Room

A conference room should be included in the plans for a modern physical education plant to serve athletics, physical education, and recreation. There is frequent need for interdepartmental administrative and staff meetings. Student oral examinations and small-group discussions are best carried out in a room designated for these purposes.

A large table with adequate seating situated in a well-ventilated, attractive room is recommended. A closet area is convenient for visitors and guests. Usually, a small table for refreshments is provided. Consideration should be given to a kitchenette. Depending upon the needs of the particular school, the room can serve such other purposes as staff lounge, reading room, film viewing area, and so on.

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Service Area Check Lists

Locker Room

1. The main locker room is strategically located for the practical use of all facilities. _____
2. The locker room is of sufficient size to accommodate peak loads. _____
3. There is adequate ventilation in the locker room. _____
4. The floor surface is safe and easy to clean and maintain. _____
5. The floor has been designed to enable thorough hosing down and proper drainage. Hose bibbs are installed. _____
6. The electrical switches and sockets are waterproofed and installed so as to eliminate dangers from shock. _____
7. The lockers are mounted off the floor and have been placed for traffic control and dressing comfort. _____
8. Sufficient bulletin boards are available. _____
9. A public address system is included. _____

10. The locker room is contiguous to the shower room, drying area and toilets. _____
11. Adequate grooming areas have been provided. _____
12. The grooming areas include wash bowls, mirrors, soap dispensers, hand towel dispensers and hair dryers. _____
13. The lockers are of substantial quality and design so as to make for long term use and easy maintenance. _____
14. Lighting fixtures are vapor-proof and centered between aisles. _____
15. Windows, if used are high enough so valuable wall space is not lost. _____
16. Skylights, if used, are centered between aisles. _____

Shower Room

1. The shower rooms are centrally located in relation to the dressing rooms served. _____
2. The shower rooms are grouped in close proximity to service multiple areas whenever possible. _____
3. The shower room has sufficient capacity to handle peak loads. _____
4. The hot water supply is sufficient to meet peak load requirements. _____
5. The shower heads are mounted at the ideal height and angle for the various users. A single control is used to regulate water temperature for each shower. _____
6. At least 10% of the shower heads for women are in individual booths close to the toweling area. _____
7. The plumbing is designed for economical maintenance. _____
8. Soap receptables are provided even if a soap dispensing system is planned. _____
9. The doorways in the shower room are wide enough for two-way traffic. _____
10. The walls and ceilings are moisture-resistant and can be maintained easily. _____
11. The floors are nonskid material pitched away from the dressing area and toward adequate drains. _____
12. An efficient ventilation system has been installed. _____
13. The toweling room is contiguous to the shower room and is of sufficient size to handle peak loads. _____
14. There is an adequate number of drains through-out the shower room facility to handle peak loads as well as possible emergencies. _____
15. The floor and wall corners are rounded for efficient cleaning. _____
16. The area is easy to supervise. _____

Storage and Issue Rooms

1. The storage areas conform to fire laws. _____
2. The equipment room, with respect to size and layout, has been designed to meet future needs. _____
3. The storage and issue areas are centrally located and can effectively handle peak periods. _____
4. There are sufficient storage areas to allow for segregation of out-of-season storage, equipment of limited use, and equipment that is used daily or weekly. _____
5. The doors to storage areas are wide and do not have a riser. _____
6. The storage area is flexible, has adjustable shelves, and includes space for mobile modules. _____
7. There is an adequate repair center away from high activity areas. _____
8. There are facilities for record-keeping. _____
9. The storage areas have appropriate security. _____

Team Rooms

1. The team locker room(s) are designed so that they are flexible for future expansion (i.e., additional sports teams formed). _____
2. The concept of separate outside locker rooms for men and women sports such as football, soccer, basebell, softball, track and lacrosse has been given careful consideration. _____
3. The team rooms are in the form of a total complex, including coaches' offices, locker areas, toilet facilities, training room, storage facilities, and meeting or lecture room. _____
4. The rooms are large enough to handle the total team. _____
5. The lockers are large enough to provide for storage of clothing as well as playing uniforms. _____
6. The lockers are well ventilated and the locker room has an efficient ventilation system. _____
7. Equipment for team meetings (chalk boards, information boards, and projectors and screen) have been provided. _____
8. The team rooms are connected with the public address system. _____
9. The team locker room, showers, and storage conform to the check list for each of these areas. _____
10. The room can be adequately secured. _____

Coaches' and Instructors' Dressing Room

1. The room is conveniently located. _____
2. There is adequate floor space and associated facilities for peak loads. _____
3. Each individual has adequate personal storage space and a preparation and record keeping area. _____
4. The floor is nonskid and easy to maintain. _____
5. An intercommunication system and telephone are included. _____
6. An information center, chalk board and clock have been provided. _____
7. There are shelves provided for teaching materials, reference sources, etc. _____
8. There is at least one area where private discussions can be held. _____
9. Full-size lockers are available for all coaches throughout the year. _____

Laundry

1. The laundry is located directly off a corridor and near the locker and equipment rooms. _____
2. The laundry is located close to the other plumbing services. _____
3. There is adequate space to house the machines, provide for storage of the clothes and supplies, provide for the performance of routine tasks, and room for maintenance and repair of the machines. _____
4. The floor is made of nonskid material, sloped and has adequate drains. _____

5. The size and quality of the machines are adequate to meet future requirements and to give long term service. _____
6. The room has been soundproofed. _____
7. The walls and ceilings are moisture-resistant. _____
8. The door ways have flush sills and are wide enough to allow for replacement of machinery. _____
9. There is easy access if laundry needs to be transported from the building. _____

Trainer's Room

1. The layout of the training room controls traffic and reduces crowding with the most frequently used areas close to the entrance. _____
2. The floor space is adequate to meet peak loads. _____
3. The room is conveniently located. _____
4. Ambulance service has access to the building which leads directly to the training room. _____
5. The room is constructed to tolerate moisture and heat. _____
6. Adequate wall plugs of sufficient voltage are located throughout the rooms about two feet from the floor. _____
7. The floor is of nonskid material. _____
8. There is a sink, a drainboard area, and a supply of hot and cold water. _____
9. There is adequate space for an office which could double as a private examination room. _____
10. There is a telephone and an intercommunication system included. _____
11. Adequate provision is made for expansion of facilities as the program grows and staff increases. _____

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(See annotated bibliographies in appendix for related articles)

VII. Recreation and Park Facilities

Recreation and Park Facilities

Planning for Leisure Through Recreation Concepts

INCREASED LEISURE TIME, coupled with an increase in discretionary income, is resulting in an activity participation explosion in the recreation field. Facilities must be designed to accommodate a wide range of age groups, social mores, and physical attributes of the population. Also, program emphasis should be oriented to recreational use as well as to structural and competitive athletic activities.

Community Involvement

In developing plans for new recreation and park facilities, and in proposing improvements to existing recreation parks, the facilities must reflect the wants and needs of the community. Public cooperation and involvement in the initial planning stages will serve to strengthen community interest both actively and financially.

There are many ways to involve the public in the planning process. One is the public meeting. Although time-consuming, a series of well-organized public meetings is an effective means of presenting proposed plans for community consideration.

A survey of leisure behavior and attitudes can be a useful tool in ascertaining the needs and desires of the people within the planning area. Many users are found in the community at large, outside school populations. Thus, inter-agency agreements for shared use of facilities is on the increase. Also, cooperation between community agencies and organized groups facilitates planning, promotes financial considerations, and assures community involvement.

The relatively new field of Industrial Recreation is looming as the next major area of progress in the recreation field. Management and employees are discovering the benefits of industrial fitness programs. As a result, industries throughout the country are expanding current facilities or establishing new recreational complexes. Programs such as these range from multi-million dollar facilities with special equipment and a medical and professional recreation staff to programs offered in conjunction with local Y's or school systems (See Figure 1).

Again, because industrial recreation/fitness programs encompass such a wide range of opportunities, public and private interests must cooperate to provide the best facilities possible.

Planning Considerations for Metropolitan Areas

As a result of the population shift to the urban centers, open space is at a premium within the confines of the metropolitan areas and there has been a general decline in the environmental quality of these areas. This has led to a growing public concern about recreational facilities and services. So, we must consider these factors when planning recreational facilities within these congested areas.

- Lack of open space and often lack of economic resources make it mandatory that all government and public agencies cooperate in planning facilities for maximum use. Recreational use of public housing facilities, social and health care programs in recreational centers, and swimming pools adjacent to or part of fire stations are just a few examples of ways in which the public can maximize facility use.
- Additional or secondary uses of all facilities, both public and private, must be considered. For example, the parking lot of a large industrial plant can be used for recreational purposes on weekends with little or no additional cost if properly planned.
- The mobility of people in dense urban areas is often restricted. Therefore, facilities must be easily accessible to the people.
- Plans should be revised for maximum use of existing facilities. Twenty-four hour use should be considered as a possibility in some areas.

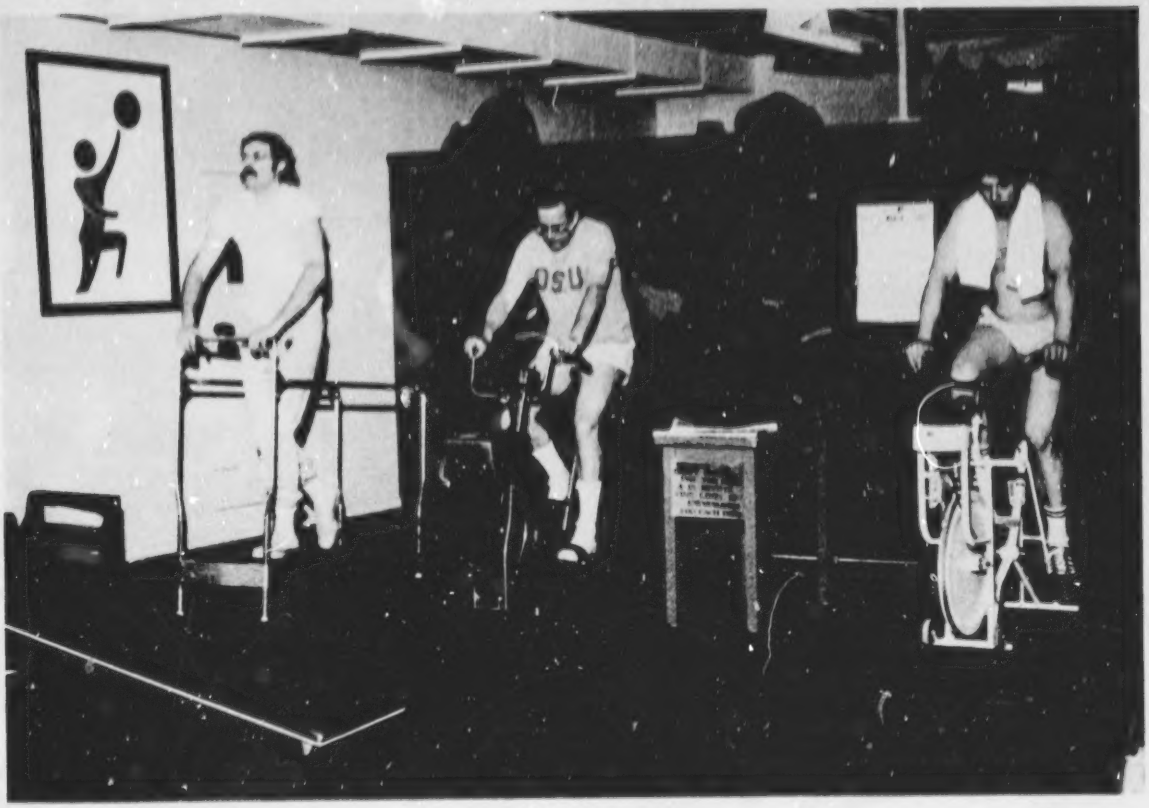


Figure 1
Battell Laboratories Employees' Health Fitness Center, Columbos, Ohio

Multiple Use

Planning facilities for multiple use is a major consideration in the establishment of playgrounds and other recreational properties. Multiple use facilities require space that can accommodate varied activities for all age groups during various times of the day, week, month, season, or year. Most activities are associated with specific times and/or seasons. Basketball and hockey are considered winter activities, baseball is played in the spring and the summer, and football is a sport for autumn. Thus, a facility that is planned to accommodate a single use becomes an expensive investment if allowed to stand idle much of the year.

Changing recreational preferences require that indoor and outdoor areas not be restricted with permanent spatial and architectural fixtures designed for specific activities in a set period of time. There must be a flexibility built into indoor and outdoor facilities comparable to the open classroom in the field of education.

The character and location of the population are constantly changing. The ethnic, socio-economic, and demographic features such as age and family size vary within a neighborhood as the years pass. With today's mobile population a community that is planned on the basis of a static population soon has many obsolete features.

Eliminating Architectural Barriers

It is essential that all recreational facilities be designed to serve the handicapped. Therapeutic recreation services must involve the special members of the population in the planning process to ensure that acitivities and facilities will serve their needs. Guidelines for the elimination of architectural barriers are detailed in Chapter 8.

Indoor Community Areas and Facilities

Related aspects of the various types of planning units (neighborhood, community, city or school district, and county or region) were discussed in Chapters 1 and 3. Relations among planning units, however, are often changed by physiographic or demographic changes occurring in the planning entity. A new neighborhood might be formed by a significant change in housing or in nationality, or a community might be divided into two neighborhoods by a new expressway. These factors are taken into consideration when defining units.

Use of Planning Units

Population units form the basis for planning programs and activities.

The park and recreation agency, in order to plan and manage its services properly, establishes its activities and facilities on the demands of a known population with given economic and ethnic characteristics. The larger the planning and managing agency, the broader the population group with which it will be concerned. An undefined population unit results only in arbitrary allocations of services and provides no accountability nor relevancy. Every effort should be made to provide for recreational programs and areas in most effective and efficient manner.

General Recreational Buildings

Recreational buildings should be planned to meet the needs and interests of all people in the neighborhood or community, regardless of age, sex or ability. They should provide a safe, healthful, and attractive atmosphere in which every person in the community or neighborhood may enjoy his leisure by participating in activities of a social, inspirational, cultural, or physical nature.

Improved technology, increased self-awareness, and great advances in the field of medicine have all contributed to the longer life span. In addition, it is estimated that one out of seven people in our nation has a permanent disability. Therefore, there is a greater challenge than ever to prevent the construction of architectural barriers, which make it difficult for the aging and the disabled to participate in the recreational program (See Chapter 8).

Recreation buildings may range from the simple picnic shelter to the complex community recreational building with its variety of special service facilities. They may vary in design from the rustic to the contermporary.

Unlike many of the early structures, present-day buildings provide for adaptability and multiple use. This change from the simple to the complex has stimulated the development of a variety of recreational buildings. These are classified by function and then categorized by size. The size of recreational buildings is usually based on the population to be served and the program to be conducted.

The Neighborhood Center

The mainstays of the recreational program are the recreational opportunities provided at the neighborhood level. The neighborhood recreational center, designed to serve an area of approximately 8,000 persons is believed to be the best recreational facility investment.

This building encloses 15,000 to 25,000 square feet. The size will depend also on whether the building is a separate entity or part of a park-school complex where facilities are available in the school.

The nieghborhood center usually includes the following facilities:

- Multipurpose room or rooms
- Gymnasium (if not available in neighborhood school)
- Shower and locker rooms, when a gymnasium is provided
- Arts-and-crafts room
- Game room
- Kitchen
- Restrooms
- Lounge and lobby
- Office
- Large storage areas.

The Community Center

The community recreational building functions beyond the primary purpose of serving a neighborhood. It is designed to meet the complete recreational needs of all the people in the community.

The size of the building depends on (a) the number of people to be served, (b) the projected program plan, and (c) whether it is a part of a park-school site or a separate building. This building usually contains 20,000 to 40,000 square feet of space, and is usually located in a major recreational area such as a park-school site or community park.

The community center usually includes the following facilities:

- Multi-purpose rooms
- Gymnasium
- Shower and locker rooms

- Stage and auditorium (sometimes combined with gymnasium
- Rooms for programs in the arts (art, dance, music, drama)
- Game room
- Kitchen
- Restrooms
- Lounge and lobby
- Office
- Large storage areas
- Clubs or classrooms
- Possible specialized areas as program dictates (racket courts, gymnastics, weight and exercise room, photography workshop, and so on).

Multipurpose Room

The multi-purpose room should be designed to accommodate such activities as general meetings, social recreation, active table games, dancing, dramatics, music, concerts, banquets, and the like.

The area of this room should be approximately 2,000 to 3,000 square feet. It should be rectangular in shape, with a minimum width of 40 feet. The minimum ceiling height should be 16 feet.

Vinyl-asbestos flooring is recommended for this type of facility. The floor should have a nonskid surface to prevent many common accidents. It is recommended that the floor also be level in order to permit multiple use for meetings, dancing, dramatic presentations, and so on.

The entrance should contain double doors and should be at the end opposite the stage. Each door should have a minimum unobstructed opening of at least 32 inches, with a removable mullion.

Gymnasium

The structure should be at least 90 by 100 feet, with a minimum height of 24 feet. This size will permit a basketball court of 50 by 84 feet, with additional room for telescopic bleachers seating approximately 325 spectators on one side of the gymnasium.

Provision should be made for a mechanical ventilating system with air-conditioning considered where climate dictates. It is preferable to have no windows in the gymnasium. However, if desired, windows should be placed at right angles to the sun at a height of 12 feet or more, and they should be equipped with protective guards. The wainscoting, or tile, in the gymnasium should provide clear, unobstructed wall space from the floor to a height of 12 feet.

Maple flooring is commonly used in gymnasiums, although synthetic surfaces are gaining in popularity. The cork spring clip or other type of expansion joint should be installed on all four sides. If suspended apparatus requiring wall attachments is used in the gymnasium these attachments should be at least seven feet above floor level.

Recessed drinking fountains should be located where they will cause a minimum of interference. Fountains should be hand- or hand-and-foot operated, with up-front spouts and controls. Protective floor covering or drainage at the base of the fountain should be considered to avoid floor damage. More detailed information concerning gymnasium construction is found in Chapter 3.

Locker and Shower Rooms

Locker and shower rooms must be provided for physical activities, athletics, faculty and the like. For further details concerning locker rooms and facilities refer to Chapter 6.

Stage and Auditorium

A stage and related facilities may be built in conjunction with the gymnasium or multi-purpose room. If space and funds allow, however, a separate unit is preferred.

The stage proper should be about 20 feet in depth, and the proscenium opening should be at least two-thirds the width of the room. The approach to the stage from the floor of the main room should be by inclined ramp with a nonskid surface to facilitate the physically disabled and aging, and to accommodate the movement of equipment.

The room should be equipped with a modern public address system, permanently installed with matched speakers and outlets for additional microphones and phonographic equipment. Consideration should be give to a master control from the office of the building. All stage lighting should be modern and should be controlled from a dimmer-control cabinet equipped with a rheostat.

The base and wall of the room should be equipped with electrical outlets to accommodate floor and table lamps, motion picture equipment, floodlights, and other electrical apparatus. A heavy-voltage line may be necessary. Provisions should also be made for installing television program equipment.

The entrance should contain double doors. Stage doors should be of sufficient width and height to facilitate the movement of scenery. It is desirable to have a door at the rear of the stage area to permit the handling of stage properties and scenery. Adequate exit doors should be provided and should be equipped with panic hardware. Door frames and thresholds should be flush.

Space should be provided for the storage of chairs, tables, and portable staging. This space can be under the stage or in an adjacent storage room provided with dollies having swivel ballbearing fiber or rubber-covered casters.

Acoustics are an important factor in an auditorium and should be kept in mind in the selection of materials for walls and ceilings. Rigid acoustic materials for ceilings are more economical and discourage vandalism better than suspended acoustical tile.

Arts and Crafts Room

A separate room for arts and crafts is desirable. However, if this is not possible, at least one club room should be equipped for crafts, with provision for gas, compressed air, and a modern sink with hot and cold water. The sink should have a clay trap.

Ample storage cabinets, closets, or lockers should be included for the safe storage of craft materials, unfinished projects, and exhibit materials. Base and wall plugs should be provided in all club rooms for the operation of electric irons, sewing machines, power tools, movie projectors and other equipment. If a kiln is used, it should be equipped with a heavy-duty 220-volt electrical outlet. Bulletin boards and exhibit cases may be used to display completed projects.

Game Room

The game room, approximately 30 by 64 feet in size, is designed for a variety of games, including pool and table tennis. In planning this room, sufficient storage space should be provided for the various items of game equipment and supplies.

This room should be close to office supervision and should be acoustically treated. The choice of floor material should be carefully considered because of the heavy traffic anticipated in this room. Windows should be placed high in the walls to reduce glass breakage. A chair rail or wainscoting to prevent the marring of walls should be installed to a height of three feet above the floor. Whenever possible, noncontact (nonmarring) furniture should be used.

The game room should include tables for billiards, table tennis, and other popular table top games (Figure 2, 3).

Kitchen

A kitchen is desirable for most community and neighborhood recreational buildings. If large dinners or banquets are to be served, provision should be made for a full-size kitchen that conforms to local health regulations and has a free floor space at least 54 inches wide.

The kitchen should be located near the club rooms and the gymnasium, so it can be used for small gatherings in the club rooms and for large banquets in the gymnasium. The kitchen is often placed between two club rooms and made available to both rooms by the use of aluminum roll-up doors.

Adequate storage space, cabinet space, and electrical outlets for such appliances as the refrigerator, range, dishwasher, and can openers should be provided. Exhaust fans should also be installed.

Lounge and Lobby

The lobby is located just inside the entrance of the recreational building. The lounge should open off the lobby and, if possible, should be close to the central office and to the multipurpose room and/or gymnasium. The lounge and lobby are are often combined into one room.

This facility should be attractively lighted and should contain a wall-mounted, recessed drinking fountain and a lighted trophy case and bulletin board. Provision should be made for public telephones, and at least one telephone should be installed to accommodate a person in a wheelchair. Adequate space, preferable recessed, and electrical and water connections for automatic vending machines should be included.

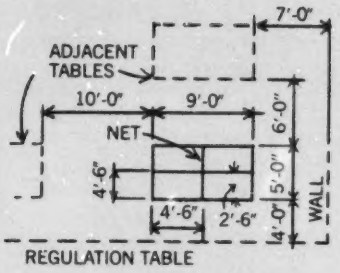
Lobby entrance doors present a problem from the standpoints of aesthetics, safety, security, and vandalism. Solid-glass panels—from ceiling to floor—and solid-glass doors are quite popular and attractive, but can be easily broken. Good aluminum doors with a minimum of glass are preferable.

Carpet floor covering is desirable for the lounge and lobby area. However, terrazzo, quarry tile, and patio tile are preferred when cigarette damage is a possibility.

Office

The office area, containing approximately 120 square feet, should be located near the main entrance with adequate window space to provide maximum supervision. However, provision must be made to insure privacy when dealing with disciplinary problems, small meetings, and the like. Secretarial and program offices should be adjacent to the director's office.

An adjoining shower/dressing unit with a floor surface area of not less than 100 square feet is often recommended. A storage closet with burglarproof door for storing valuable supplies and equipment should adjoin the administrative offices.



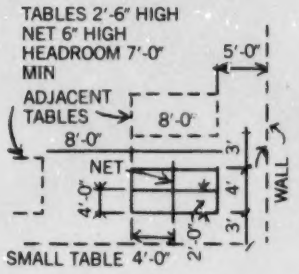
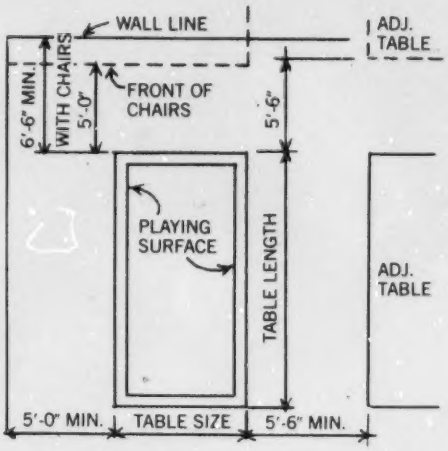


Figure 2
Table Tennis



DIMENSIONS FOR BILLIARDS & POCKET BILLIARDS

	PLAYING SURFACE		TABLE SIZE	
TYPE OF TABLE	W.	L.	W.	L.
ENGLISH (SNOOKER)	6'-0"	12'-0"	6'-9"	12'-9"
STANDARD POOL OR BILL.	5'-0"	10'-0"	5'-9"	10'-9"
STANDARD POOL OR BILL.	4'-6"	9'-0"	5'-3"	9'-9"
STANDARD POOL OR BILL.	4'-0"	8'-0"	4'-9"	8'-9"
JUNIOR POOL	3'-6"	7'-0"	4'-3"	7'-9"
JUNIOR POOL	3'-0"	6'-0"	3'-9"	6'-9"

TABLE HEIGHT 2'-6" ±

Figure 3
Billiards and pocket Billiards (Pool).

Storage Areas

One of the most common errors in planning recreational buildings is lack of sufficient storage space for equipment, maintenance, and custodial purposes.

An area adjacent to the gymnasium should be provided for storing apparatus and equipment. It should have a six-foot-wide opening, with flush, louvered doors and a flush threshold, to permit passage of the most bulky equipment.

The minimum size of the storage room should be approximately 250 square feet. Provision should be made for storage of inflated balls, bats, softballs, and other supplies, either in separate cabinets or a special closet. Appropriate bins, shelves, and racks are suggested. In addition, a recessed alcove for the storage of a piano is desirable.

The maintenance storage room varies in size, depending on the adjacent outdoor space and the size of the building. The room is ordinarily located on the ground level, adjacent to the outdoor areas. An outside entrance should be provided by means of a burglar-proof door large enough to permit the passage of motorized maintenance equipment. Recessed wall shelving and cabinet storage should be provided for tools, supplies, and equipment. This space should also contain hot and cold water, a slop sink, a lavatory, a water closet, and a clothes closet. The floor should be concrete and pitched to a central drain. The junction of the floor and wall should be coved.

A supply closet equipped with a slop sink and space for mops, pails, brooms, and cleaning supplies should be centrally located on each floor level.

Club or Classrooms

Experience indicates the desirability of providing a minimum of 500 square feet of floor space per club room. For community recreational buildings, at least three to five club rooms should be provided for multiple use. At least one large club room should be located adjoining the kitchen.

When windows in club rooms and lounges are placed high in a wall, they are not broken as often as low windows and they also provide more space for furniture, bulletin boards, pegboards, chalkboards, and exhibits. Since broken window glass is a major problem, a nonbreakable type of pane is preferred. Windows may be omitted and sky domes and vent domes use, eliminating the need for drapes, Venetian blinds, and curtains—all items subject to vandalism.

A chair rail or wainscoting to prevent the marring of walls should be installed to a height of three feet above the floor. Whenever possible, noncontact (nonmarring) furniture should be used. Floor-level radiant heat in rooms where programs for small children will be conducted should be considered.

Photography Room

A special room can be equipped as a darkroom. Ventilation should be provided through light-proof ventilators. Hot and cold running water, special light plugs (both wall and base) and photographic sinks for developing and washing prints should also be provided. A mixer is desirable to control the water temperature accurately. A filter should also be provided if the water quality is not good. Doors should be light-proof.

Music Room

The size of the music room should be determined by the potential number in the choral or instrumental group using this facility at any given time. A guide commonly used is to allow 20 square feet for each participant. Provision should be made for the storage of music, instruments, band uniforms, and supplies. Shelves are commonly used for storage of musical equipment.

Auxiliary Gymnasium

The auxiliary gymnasium is for such activities as wrestling, weight-lifting, tumbling, fencing, and apparatus work. Acoustic treatment for this room is desirable.

The size of the room and height of the ceiling will depend on the various activities for which this facility will be used. The floor should be treated with material that will withstand the use of such equipment as heavy weights.

At least one well-ventilated storage room will be needed for equipment and supplies used inthe auxiliary gymnasium. If the apparatus is to be cleared from this room, an additional apparatus storage room should be provided.

Instructor's Office

If the recreational program is of considerable size, there should be an office for instructors and leaders. It should be approximately 120 square feet in size and should be adjacent to the gymnasium.

A dressing room opening into this office should be provided for the activity leaders. This facility should contain a shower, water closed, lavatory, and clothes closet. Proper ventilation should be provide for all rooms.

Checkroom

The size of the checkroom will depend on the magnitude of the program. This room should open into the lobby and should be equipped with a Dutch door, shelves, and portable hanger racks.

Specialized Recreation Buildings

Many cities and communities provide recreational programs that require specialized facilities. While the construction of these facilities can be justified in the majority of cases, care must be taken to provide for maximum year-round use. The specialized centers should be centrally located to serve all the public.

Art Center

In recent years many cities have constructed a community art center to satisfy the public demand for programs in the arts. The size of the facility will be determined by the number of people to be served and the type of art programs to be conducted. Generally, art centers will include work areas for ceramics, sculpture, painting, and sketching. Depending on the interests in the community, a center may also include facilities for woodworking, lapidary, stonecutting, and other arts and crafts. Some art centers include facilities for dance, music, and dramatic classes and programs as well.

Pre-school Center

Pre-school centers for day care, Head Start, and nursery school programs are being built in some communities with the aid of federal funds. These buildings are smaller than neighborhood center buildings, and the design scale is geared to pre-school children. Generally the centers include a large multi-purpose room, small rooms for small-group activities, an office, possible a kitchen and eating facilities, and ample

Figure 4
Laura M. Burch Memorial Teen Center, Cortland, N.Y., a multi-purpose center.

storage space. Special care should be taken to ensure good acoustic treatment in the center.

Senior Citizen Centers

Senior citizen centers are similar in design to neighborhood recreational centers. However, more emphasis is placed on facilities for the arts, areas for discussion and rooms for passive games than for large-scale physical activities. While a gymnasium is seldom found in a senior citizen area, a large multi-purpose room is needed for square dance, shuffleboard, and similar activities.

The senior citizen center should be a single-floor building, and special care should be taken to eliminate all hazards such as steps and protrusions on walls.

Swimming Pool (Natatorium)

Many neighborhoods and communities have a considerable interest in swimming and demand that a swimming pool be included as part of the recreational building. For maximum year-round use, the indoor-outdoor pool is recommended. The construction cost of this type pool is greater, but the value of having a year-round rather than a seasonal activity is more important to the community or neighborhood. (See Chapter 4 for complete information on swimming pools.)

Teen Centers

While teen centers (See Figure 4) have been very popular and continue to be built, the trend today is to construct multi-use centers that will provide opportunities for teen programs along with other activities. For example, a teen office and lounge are provided in many community recreational centers.

When a separate teen center is desired it should include:

- multipurpose
- gymnasium
- shower and locker rooms
- rooms for programs in the arts
- restrooms
- game room
- lounge and lobby
- office.

Indoor Tennis

There are avid tennis players across the country who want to play all year, but cannot due to inclement weather. Thus, various communities and organizations are building indoor tennis facilities.

These structures vary in size, cost, and purpose, depending on the type of facility needed and the funds available. The most common types of facilities are conventional buildings, air structures, and systems type structures.

Excellent lighting is the key to a successful operation. Some indoor courts have sky lights or translucent panels to allow natural light to enter. However, in many cases natural light causes an unwanted glare. If possible, a complete lighting system should be installed. Lighting should provide a minimum of 100 footcandles evenly distributed on the court. The four types of lighting most often used are:

- *Incandescent* This type of lighting is relatively inexpensive to install, but is more expensive than other types to operate. Incandescent lighting can also cause unwanted glare.
- *Fluorescent* This type of lighting is more expensive to buy, has long life, and is less expensive to operate. The light supplied is soft and very adequate, but the lights grow dimmer with age. The lights also cause a distracting blinking when they are burning out. The direct light is disconcerting when serving or returning lobs.
- *Mercury Vapor* This type of lighting system produces a great deal of light. The biggest drawbacks are that it is slow starting, produces a discoloring effect, and is expensive for initial installation.

- *Metal Halide* This is used as an indirect lighting system with tennis courts. No glare is produced because of this indirect light. Metal halide lighting also lights the entire object, not just the top as with most other lights systems. The light causes no discoloration like that found with mercury vapor. The only disadvantage of this type of lighting is that it is slow starting, with two or three minutes required for the system to reach maximum power.

Court surfaces vary from standard asphalt to many synthetics. Highly cushioned surfaces give slower play and higher maintenance costs. Resilient surfaces are recommended, but the degree of resiliency can be a matter of judgment.

Unobstructed overhead should be at least 30 feet over the center of the court, and 35 feet is better. A two-court battery should be at least 120 by 120 feet in order to provide sufficient room for backcourt play.

Temperatures should be maintained at 60 to 65 degrees. Gas radiant heating has proved to be most economical. Adequate ventilation is required to avoid humidity problems during the cold season and to provide playing comfort in the warm season. Air-conditioning is a questionable need because of cost of construction and operation. Many courts are using ceiling fans to increase air circulation and, at the same time, decrease energy consumption.

Space is required for men's and women's dressing rooms along with shower facilities. The practice of assigning permanent lockers to individuals should be avoided so that a limited number of lockers can be provided. For example, in a four-court building the maximum locker requirements would be 32 lockers each for men and women, if permanent lockers are not assigned.

Space for a pro shop should be provided for sale of balls, rackets, and wearing apparel. Racket stringing is a desirable service.

A nursery room for the small children of tennis-playing mothers is most important. Office space, storage, and lounge areas are needed. Some indoor tennis facilities have also provided such optional features as saunas, exercise equipment rooms, whirlpools, and steam rooms.

Additional tennis court information is contained in Chapters 2 and 3.

Racquet Clubs (and Courts)

The fitness movement has spawned tremendous interest in the sport of racquetball. Courts are being built as separate racquetball complexes or in combination with tennis, swimming, and conditioning activities as sports clubs. Court construction originally followed the pattern of handball courts, but the fast growth of racquetball has encouraged the development of courts which meet the needs of racquetball specialists.

Recommendations for court construction:

Location

Temperature differences inside and outside of courts can cause condensation to form on walls. For this reason, avoid placing a wall immediately adjacent to a swimming pool or having a playing wall exposed to outside building walls without providing air space.

Corridors

- Corridors should be illluminated with direct lighting.
- If glass walls are used, the background area should be of a light color.
- Place enough electrical outlets around the corridor area for maintenance and repair needs.
- Carpeting is a low-cost material that is aesthetically pleasing and can reduce maintenance costs.
- Install switches for individual courts in the corridors. Key covers may be used to reduce electrical use.
- Bulletin boards are needed in the corridor area.
- Provide space for storage of telescoping scaffold to replace lights.
- Consider space for storing and issuing equipment.

Floors

- The wood floor is the most popular and gives improved player performance. Synthetics are less expensive, but require increased maintenance care.
- The foundation should be concrete to give a level floor surface that allows side panels to meet flush with the floor around the entire court.

Walls

- Most court systems use a plastic laminate or pressed masonite-type wall. Excellent performance and low-cost maintenance are available with the packaged court systems.
- Plaster walls are still used occasionally. Exact specifications must be adhered to and it must be completed under exact temperature and humidity conditions. Maintenance is high because of racquet damage to the walls.
- Light colors should be used on walls.

Ceilings

- The same material as side walls should be used to achieve maximum trueness of bounce.
- The use of acoustical treatment on the rear ⅓ of the ceilings and in the balcony will reduce noise level.
- Laminated panels can be premachined to fit architectural designs for lighting, heating, ventilation and air-conditioning.

Lighting

- Lighting should be flush-mounted and designed for 50-60 foot candle illumination.
- Courts should be designed for individual lighting.
- Avoid the reflection of direct sunlight into courts.
- Mercury vapor, metal halide, and fluorescent lights are normally used. The types selected vary according to initial costs and upkeep.

Doors

- For safety purposes, doors should open to the corridors in most installations.
- Doors should have flush pulls and hinges.
- A small shatter-proof window or slot fisheye installed flush with the interior surface should be located at eye level of the average adult.
- Doors should be large enough to allow a scaffold to be brought in for painting and changing lights.

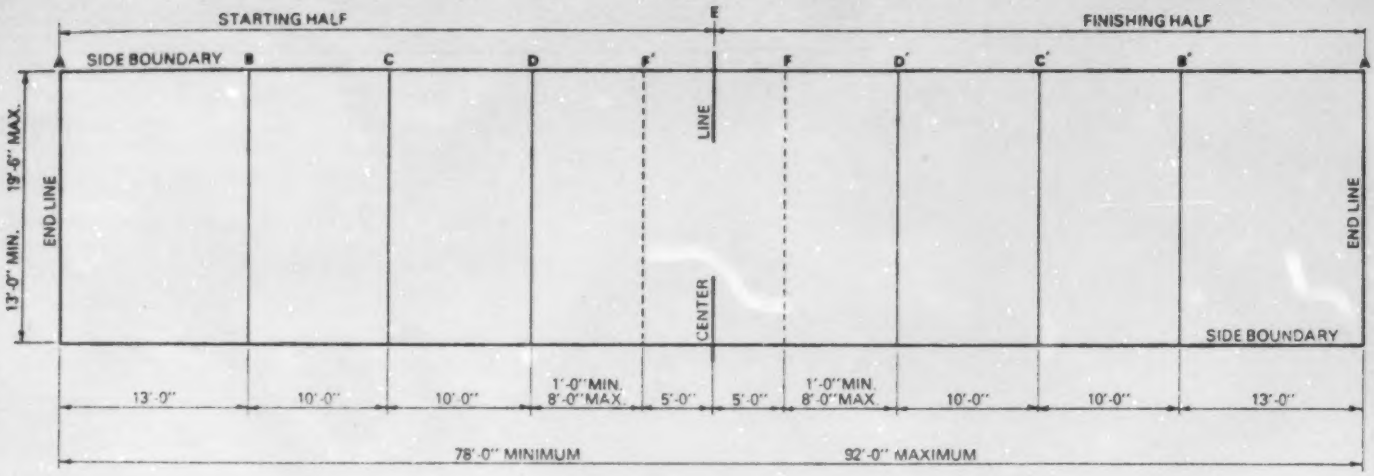


Figure 10
Layout of a Bocce court

Figure 5
A private tennis facility with...

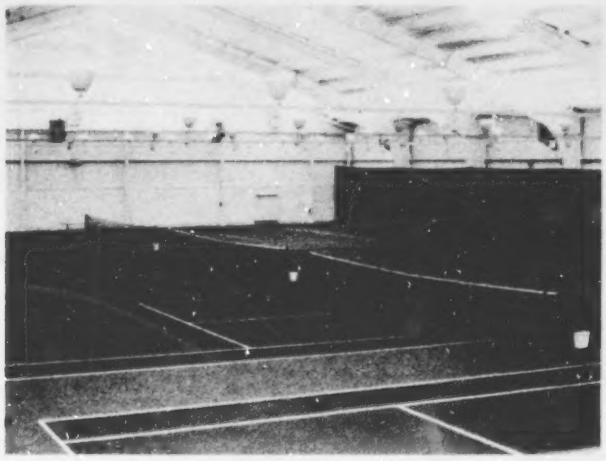


Figure 6
indirect halide lighting and synthetic surface

Figure 7
Exterior of private handball club

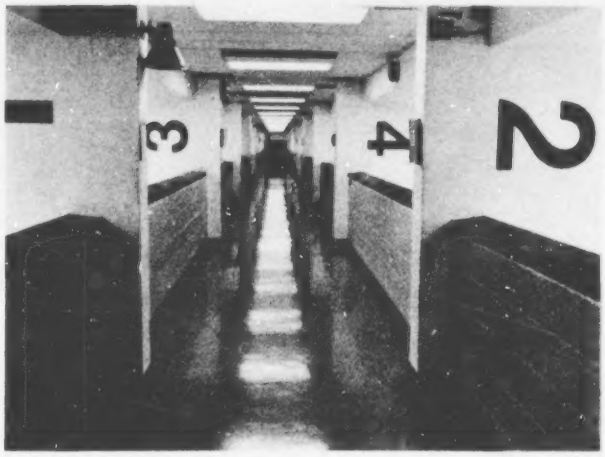


Figure 8
Observation deck at the club

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Heating and Air-Conditioning

- Refrigerated air-conditioning or at least forced ventilation is essential for individual courts.
- Design air-conditioning for 4 - 6 changes of air per hour.
- Desirable temperatures range from 60-70 degrees.
- Humidity should be controlled between 40-60% for ideal playing conditions.

Exact dimensions and a sample layout are included in Chapter 3.

Bowling Lanes

The construction of bowling facilities is a complex architectural and engineering task. Specialists should be consulted and brought into the planning at an early date. Major suppliers of bowling equipment will provide excellent architectural consultation and research services.

Bowling lanes can be used extensively for instruction, recreational bowling, and competition. A minimum of eight lanes should be constructed to provide an effective instructional unit. With four individuals per lane, eight lanes will effectively accommodate 32 individuals. The lanes should be located for convenient access during both day and evening hours, and where noise from the pins will not interfere with other activities. It is not especially important to locate the lanes near dressing and shower rooms, as recommended for other activity areas.

The ceiling height of the room should be a minimum of 10 feet, with 12 feet strongly recommended. The width of the facility is dictated by the number of lanes. A lane, including gutters, is 60 inches wide. Eight lanes, including lane dividers and four ball-return chutes, require a minimum width of 44 feet, 8 inches. Space for a passageway to the pits must be added.

Other Specialized Facilities

Information pertinent to other specialized indoor recreational facilities can be found in Chapter 3.

The planning of a recreational building demands a precise and logical approach. Since a recreational building reflects the unique needs and interests of a neighborhood or community, the specific design will vary, but the preliminary considerations of planning objectives will be the same.

The successful incorporation of accepted planning objectives will ensure maximum use of the building. The initial functional/spatial specification and the continuous re-evaluation of the architectural specifications of the building prior to its construction should be considered in terms of the following:

Check List for Indoor Recreation Facilities

- Has most effective use of the entire structure been determined? _____
- Does the preliminary sketch include all the essential facilities necessary to fulfill the program objectives? _____
- Does the layout provide for flexibility in use and for future expansion? _____
- Does the floor plan permit convenient access to, and facilitate circulation within, the building? _____
- Does it provide for ease of supervision and administration of the building? _____
- Have individual rooms been located so as to encourage multiple use within safety limits? _____
- Has the building been designed to ensure opportunity for its use by all members of the community, including the aging and the disabled? _____
- Does the design encompass accepted aesthetic qualities that relate harmoniously to the surroundings? _____
- Is the building designed to ensure cooperative use with other public or private agencies? _____
- Is it designed to permit economy in construction and subsequent maintenance? _____
- Is it designed for sufficient and convenient storage? _____

☆ ☆ ☆

Outdoor Community Areas and Facilities

Growth projections for the next decade provide evidence that few, if any, metropolitan areas in the United States have sufficient open space to meet the demands of the future. Based on these projections, it is imperative that planning boards and commissions on all levels of government review previous planning philosophies with the intent of revision or, when necessary, the development of new master plans.

As open space becomes less and less available, greater consideration must be given to multiple use of these lands and every measure taken to use them most efficiently. Municipal and school authorities should acquire, plan, and develop areas for joint use. This process calls for professional guidance in the fields of planning, designing, and engineering, and for the advice and counsel of professionals in the fields of education and recreation.

The most efficient and successful planning is accomplished when everyone in the organization, particularly those who will be identified with the finished product, have an opportunity to participate in the planning. those who are to be served should also have a voice in the planning, through community meetings where they have an opportunity to express their interest and needs.

Standards

A variety of standards for the size, location, and number of educational and recreational areas and facilities have been proposed over the years by persons with long experience in the operation of such areas and facilities. These standards are sound when formulated to make possible a program to serve the basic needs of people for physical education and recreation. However, they are not valid in prescribing specific activities or facilities for every neighborhood. While they are a useful guide in the acquisition and construction of a property, standards can seldom, if ever, be applied completely or without modification because a typical or common situation is seldom found. Standards are formulated to indicate a basis for the intelligent development of local plans. Therefore, the standards for areas and facilities should be reviewed and appraised for each planning unit and modified whenever changing conditions warrant their revision.

Standards for areas and facilities developed by private planning firms, public agencies, and service organizations at

the local, state, and national levels have been widely endorsed throughout the United States and have provided the basis for recommendations in scores of long-range plans for school, park, and recreational systems. The proposal that at least one acre of recreation and park space be set aside by urban areas for every 100 of the present and estimated future population has been more widely accepted than any other space standard. However, this standard does not relate to the demographic or physiographic character of particular locales and is becoming obsolete. Professional and governmental authorities, including the National Recreation and Park Association and the National Park Service, have pointed out the desirablility of providing an even higher ratio of land to population in towns and small cities.

Modification of this general standard has been suggested for all planning entities based upon local requirements for populated cities. Some municipal planning officials believe the development of large outlying properties owned by the municipality will help meet the recognized deficiency in the inner municipality. However, this proposal should be considered as a practicable substitute indicative not just of necessity, but also of feasibility.

Actual studies of recreational behavior patterns verify people tend to form neighborhood recreational groups with others of similar social backgrounds. The resulting patterns might follow or be divided by arteries, depending on whether transportation is provided.

Previous number standards related to the number of tennis courts or swimming pools per thousands of people, and so forth. Such numbers do not take into consideration the land or people and the climatic and geographic locale of the planning entity. The specification and allocation of facilities should reflect the activities demanded and supply to meet the demands. Standards of so many facilities per thousand are arbitrary. They neither reflect the requirements of the community or neighborhood nor are universally applicable. A planning process of inter-action and participation by the public should determine the number of facilities from one end of town to the other.

Recreational acreage should be based on usage. Guidelines for acreage allocations for different park types are only illustrative. Every activity has a public demand. The demand for some activities is often met by the private or voluntary sector. Ski lodges, tennis centers, and other corporations all conduct market studies to ascertain the leisure needs of and probable use by their clientele. Public agencies must conduct comparable studies to analyze demand. If the municipality can ascertain the probable use, turnover, capacity, use time, and low/peak load for each activity, it can compute the number of activity stations and facilities for each activity group. This analysis is comparable to processes used to determine the indoor and outdoor space requirements for a school. The recreational acreage is then computed for actual facilities, for circulating paths and roads, for landscaping, and for other features.

Park and Recreational Areas

The types of outdoor recreational areas described here represent a variety of service units, which may be used in programs of athletics, sports, physical education and recreation. Local conditions will dictate to a large extent which types are to be used in any given locality. Hence, different combinations of areas and facilities will emerge as the solution to the problem of meeting the needs and interests of a particular locality.

There is some controversy over parkland aesthetics as measured by the terms active and passive recreation. Many individuals with inherent interest in recreational or leisure pursuits associated with nature denounce the intrusion into parklands by tennis buffs or ball players. Obviously, these two groups have different attitudes about the character of parklands. Parklands can be designed for active or passive use, or both, without destroying the aesthetic values. The use of parklands should reflect the greatest good for the greatest number and the protection of the health, well-being, and safety of all.

If a community is split over use of parklands, a cost-benefit anaylsis should be made to ascertain the feasibility and costs of trade-offs. Obviously, the character of the resources also influences such trade-offs. There is no sense in preserving a swamp that was created artificially and lacks any ecological value, but a natural swamp might be found elsewhere and preserved to meet specific needs and interests. There are alternatives in every planning process, and they should be considered. The aesthetic values of a parkland, whether oriented to play apparatus or floral displays, does not have to be sacrificed because it is termed passive or active.

Abandoned industrial sites, such as strip mines, waste disposal areas, and sand and gravel pits, offer tremendous possibilities for park and recreational development. In many cases, recreational use is not only the most beneficial, but the most economic use of such sites. The recreation planner must not overlook the possibility of obtaining these sites for public use. If possible, cooperative planning should be started while the site is still being used by industry so landscape features can be developed to make it more appealing for recreational use.

Playlot/Mini-Parks

Location, Size, and Features

A playlot/mini-park is a small recreational area designed for the safe play of pre-school children.

As an independent unit, the playlot/mini-park is most frequently developed in large housing projects or in other densely populated urban areas with high concentration of pre-school children. More often, it is incorporated as a feature of a larger recreational area. If a community is able to operate a neighborhood playground within a one-quarter mile zone of every home, playlots should be located at the playground sites. A location near a playground entrance, close to restrooms and away from active game areas, is best.

The playlot/mini-park should be enclosed with a low fence or solid plantings to assist mothers or guardians in safeguarding their children. Thought should be given to placement of benches, with and without shade, for ease of supervision and comfort for parents and guardians. A drinking fountain with step for tots will serve both children and adults.

Play equipment geared to the preschool child should combine attractive traditional play apparatus with creative, imaginative equipment. Such proven favorites as chair, bucket, and glider swings; six-foot slide; and a small merry-go-round can be used safely. Hours of imaginative play will be enjoyed with such features as a simulated train, boat, or airplane; a playhouse; and fiberglass or concrete animals. A small climbing structure and facilities for sand play should be included.

Play Apparatus Area

The design of playground equipment and play areas can

significantly affect children's psychomotor affective and cognitive development. In order to meet psychomotor needs, equipment should stimulate locomotor, non-locomotor and manipulative actions which stimulate the development of large muscles. Equipment should elicit repetitive responses as well as increasingly new complex responses. Some equipment should be permanent and stable in order to stimulate the child to move, but children should be able to move some pieces from place to place. The equipment should be child-sized, some designed specifically for younger children and some for older children.

Younger children need opportunities to create, build and manipulate the environment. Older children need play settings which stimulate multiple responses—more than one way to move from one piece of equipment to another.

Cognitive needs of children may be met by providing equipment which is multipurpose in design. Equipment should whet children's curiosity, stimulate exploration and elicit a variety of responses. Children do use a variety of bases of support as well as different kinds of level, direction and range of movement on different pieces of equipment. No one piece provides adequate variety for all children. A variety of kinds of equipment is necessary.

Affective needs may be met by varying the shapes of pieces such as squares, circles, rectangles. Varying spaces increases a variety of responses—some should be narrow, wide large, small, high and low. Some pieces should be thick (planks) while others should be thin (bars). Sculptured animals and natural objects such as tree trunks are widely used. Textures should vary from loose, soft, smooth such as sand, bark, wood chips to hard, shiny, dull, rough such as metal, wood, plastic and fiberglass and concrete.

Colors impregnated in plastic and cement prevent frequent painting. The color of the equipment should be in contrast to the ground covering in order for a child to see the support on which to place a foot. In contrast to adults, color does not affect children's choices of equipment significantly.

Some equipment should encourage socialization. Others should provide for quiet contemplation. Some play apparatus should sustain the interest of individuals. Other pieces should appear unpredictable in the nature of responses available.

Equipment chosen for outdoor areas should be consistent with materials used indoors to illustrate a coordinated curricular philosophy of recreational interests. Equipment should be usable in physical education classes as well as at recess.

Play equipment must be durable, safe and sanitary. Some pieces should be resilient. All pieces requiring cement footings should be covered by dirt or a softer ground cover. Footings should be deep enough to maintain stability. Metal pieces may need shade to keep them cool. Paint on equipment prevents rust and makes the piece cleanable. Moving parts should be oiled regularly. Nuts and bolts should be tightened frequently. Equipment requiring low maintenance is advisable.

The surface treatment under apparatus equipment is very important. Various types of materials that have been used are sand, wood chips, tanbark, asphalt, and a variety of synthetic surfaces. The use of asphalt covered with a synthetic material has been gaining in popularity because of the safety and aesthetic aspects even though the initial cost is higher. A level surface is always maintained with this treatment, which is safer for the children at play. Water puddles do not appear under swings, and less maintenance is required for this surface.

Enclosing the area may be appropriate in order to prevent nuisance legal problems. If equipment cannot be played on safely without adult supervision, a fence with a lock is a necessity.

Although home-made equipment may be durable and cost less initially, legal concerns may warrant the purchase of commercial equipment. Comparative shopping may reduce the cost of commercially-made pieces by as much as 50%.

The whole play area should be designed with the aid of educational consultants and/or commercial planners. Pieces of equipment should not only be placed by age groups, but, more importantly, they should stimulate movement from one piece to another. Moving parts require spaces for a range of movements. Equipment needs to be placed for ease of supervision and safe traffic patterns. Since the piece of equipment placed in the center of an area receives the most attention, apparatus should be changed frequently to provide children with new opportunities to explore the environment. Play areas throughout the community should reflect variety. Funds should be allocated to change locations of pieces of apparatus on each playground and between playgrounds.

Small Games Courts

The playlot/mini-park may also include courts and areas for such activities as hopscotch, marbles, and circle games. The entire small-games area can be used as multi-purpose space. These areas are located primarily in neighborhood and community park-schools and may be used for both class instruction and recreational programs.

The small-games area should be a minimum of 25 by 25 feet, adjacent to the crafts-and-apparatus area. It should be well-drained and surrounded by a fence or shrubbery barrier for maximum safety and control. The surface should be of sandy loam, asphalt, or portland cement concrete.

Hopscotch is popular with children. A special court may be marked off in one section of the small-games area (See Figure 9).

Kinds of Play Areas

One-Time User. Usually a commercial play area designed to sustain interest for a short time span.

Returning Client Play Area. Usually a school or public recreation area. Should be designed to stimulate multiple responses and some elements of unpredictability.

Adult. Currently commercial and educational planners are experimenting with equipment designed for adults. The designs are adult in size and in challenge.

Adventure. Play areas originally conceived in Europe. Children are involved in the planning, creating and building of an area. A play leader will facilitate play and construction. Some parts are fixed while others are movable. Parts can be changed frequently (daily) or periodically (at the end of a season).

Creative. Play areas which stimulate children to elicit a variety of responses rather than a single response. Loose materials as well as fixed objects are part of the setting.

Junk. Constructed, usually by adults, from discarded materials. A variety of materials enhances the choices available and stimulates multiple sensory responses: tires, telephone cablespools, railroad ties, sand, wood, turf, rope.

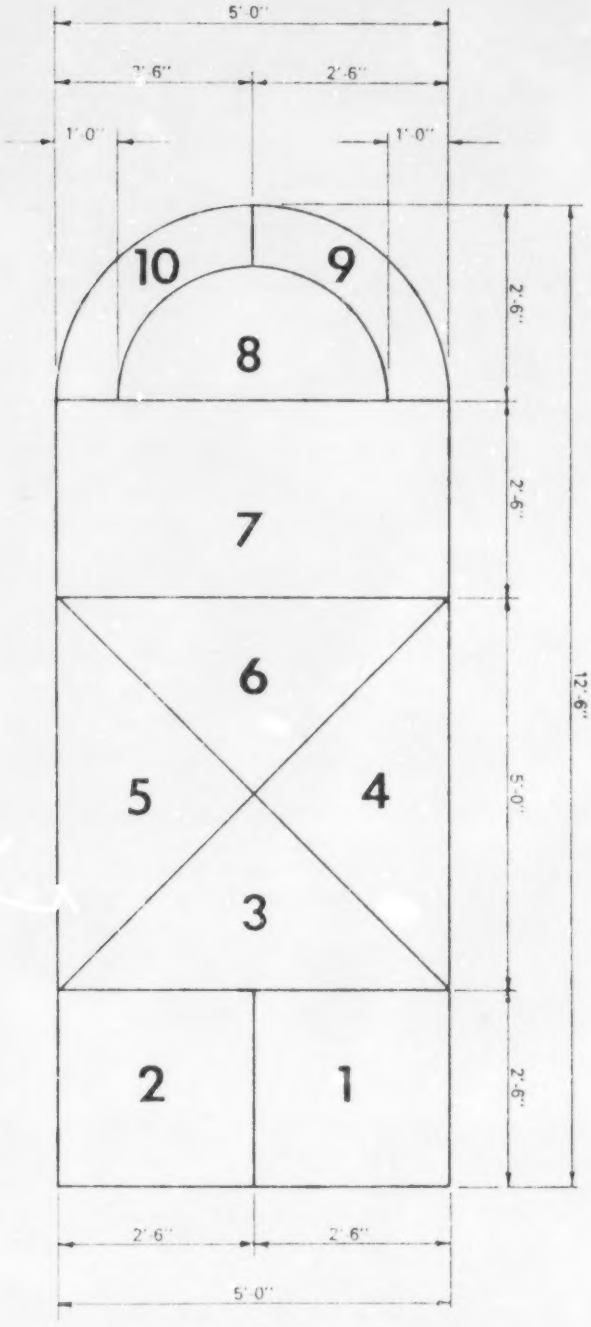
Thematic. Usually built around a central idea: pioneer, Treasure Island, Indian, seafaring, and circus traffic or trans-

portation which may feature a combination of planes, cars, or boats. Variety is important in the settings as is the appropriateness with the local environment and safety of the objects. Glass and locks should be removed.

Traditional Play Areas. Generally feature metal equipment including swings, slides, see-saws, merry-go-rounds, single purpose in design and tend to move children rather than stimulate children to move.

Vestpocket Playgrounds. Originally created by Paul Friedberg in New York for high school students—within one lot between buildings, designed on an adult scale to be compact and indestructible.

Figure 9
Hopscotch Court layout



Neighborhood Playground

The neighborhood playground is the primary area in planning for recreation. It is established primarily to serve children under 14 but should have additional features to interest teen-agers and adults. The trend in recent years is for the neighborhood playground to become the center of activity for a wide variety of needs and interests expressed by all residents. The more diversified pursuits of today's recreation consumer challenge the facility planner to provide for a broader program, with more attention devoted to multiple use by different age groups (See Figure 12).

The neighborhood playground serves the recreational needs and interests of the same population served by the neighborhood elementary school. Its major service zone will seldom exceed one-half mile, with most of the attendance originating within a quarter-mile distance. It should be centrally located in the area to be served and away from heavily traveled streets and other barriers to easy and safe access.

The neighborhood playground normally requires a minimum of five acres. The particular facilities required will depend on the nature of the neighborhood, with space being allocated according to priorities, as follows:

	Acres
Turf area for softball, touch football, soccer, speedball, and other field games	*2-3*
Hard-surface area for court games, such as netball, basketball, volleyball, and handball	*0.50*
Open space for informal play	*0.50*
Corner for senior citizens	*0.30-0.50*
Space for quiet games, storytelling, and crafts	*0.20*
Playlot	*0.20-0.50*
Children's outdoor theater	*0.15*
Apparatus area for elementary age children	*0.25-0.50*
Service building for restrooms, storage, and equipment issue or a small clubhouse with some indoor activity space	*0.15*
Circulation, landscaping, and buffer zones	*1-2*
Undesignated space	*0.75*
Total	*5 to 20*

Depending upon the relation of the property to schools and to other recreational facilities in the neighborhood, such optional features as a recreational building, tennis courts, or swimming pool might be located at the neighborhood playground. If climatic conditions warrant, a spray or wading pool may be provided. The following space for optional features should be added to the standards listed above:

	Acres
Recreational building	*0.2*
Landscape areas (if there is no neighborhood park)	*2.0*
Swimming pool	*0.5*
Tennis courts	*0.4*
Total	*3.1*

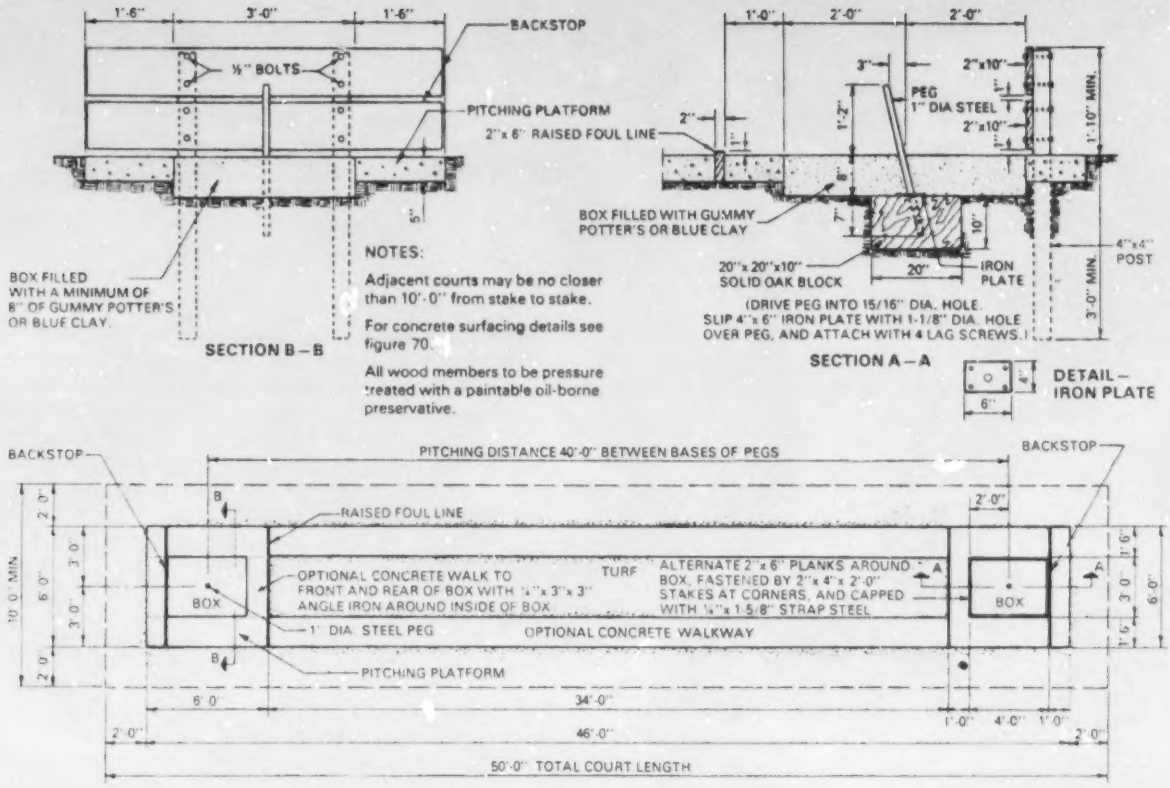

BACKSTOP
½" BOLTS
PITCHING PLATFORM
2"x 6" RAISED FOUL LINE
BOX FILLED WITH A MINIMUM OF 6" OF GUMMY POTTER'S OR BLUE CLAY.
SECTION B – B
NOTES:
Adjacent courts may be no closer than 10'-0" from stake to stake.
For concrete surfacing details see figure 70.
All wood members to be pressure treated with a paintable oil-borne preservative.
PEG 1" DIA STEEL
BOX FILLED WITH GUMMY POTTER'S OR BLUE CLAY
20"x 20"x10" SOLID OAK BLOCK
IRON PLATE
(DRIVE PEG INTO 15/16" DIA. HOLE. SLIP 4"x 6" IRON PLATE WITH 1-1/8" DIA. HOLE OVER PEG, AND ATTACH WITH 4 LAG SCREWS.)
SECTION A – A
4"x4" POST
DETAIL – IRON PLATE
PITCHING DISTANCE 40'-0" BETWEEN BASES OF PEGS
RAISED FOUL LINE
OPTIONAL CONCRETE WALK TO FRONT AND REAR OF BOX WITH ¼"x 3"x 3" ANGLE IRON AROUND INSIDE OF BOX
TURF
ALTERNATE 2"x 6" PLANKS AROUND BOX, FASTENED BY 2"x 4"x 2'-0" STAKES AT CORNERS, AND CAPPED WITH ¼"x 1-5/8" STRAP STEEL
1" DIA. STEEL PEG
OPTIONAL CONCRETE WALKWAY
PITCHING PLATFORM
BOX
6'-0"
34'-0"
46'-0"
50'-0" TOTAL COURT LENGTH

Figure 11
Horseshoe pitching layout

The addition of optional features may require provisions for off-street parking.

Neighborhood Park

The neighborhood park is land set aside primarily for both active and passive recreation. Ideally, it gives the impression of being rural, sylvan, or national in its character. It emphasizes horticultural features, with spacious turf areas bordered by trees, shrubs, and sometimes floral arrangements. It is essential in densely populated areas but not required where there is ample yard space at individual home sites.

A neighborhood park should be provided for each neighborhood. In many neighborhoods, it will be incorporated in the park-school site or neighborhood playground. A separate location is required if this combination is not feasible.

A separately located neighborhood park normally requires three to five acres. As a measure of expediency, however, an isolated area as small as one or two acres may be used. Sometimes the functions of a neighborhood park can be satisfactorily included in a community or city-wide park.

The neighborhood park plays an important role in setting standards for community aesthetics. Therefore, it should include open lawn areas, planting, and walks. Sculpture forms, pools, and fountains should also be considered for ornamentation. Creative planning will employ contouring, contrasting surfaces, masonry, and other modern techniques to provide both eye appeal and utility.

Community Parks and Playfields

This type of recreational area is required in a community where it is not feasible or possible to acquire and develop a community park-school. The community park and playfield, like the neighborhood playground, is designed primarily to provide facilities for a variety of types of organized recreational activities, but is should also have the characteristics of a landscaped park. It usually serves as the playground for the children living in the immediate neighborhood, but its primary service is to a much wider age group. Thus, it supplies a greater variety of facilities and more extensive service than can be justified at the neighborhood playground. The school child, teen-ager, young adult, hobbyist, senior citizen, and family group all find attractive facilities at the well-developed community park and playfield. Because there is no school building at this area, some type of indoor facility is needed. In may cases, a multipurpose recreational building is provided to meet this need.

City-Wide or District Park

The city-wide or district park serves a district of a large city or a total community of a small city. It should serve a population of from 50,000 to 100,000 with a wide variety of activities (See Figure 13).

The ideal location for this area is in combination with a high school as a park-school complex. Where this is not feasible, consideration should be given to placing the park as close as possible to the center of the population to be served. The land available will be a determining factor in site selection. While the service zone will vary according to population density, a normal use zone is two to four miles. The size may range from 50 to 100 acres.

Depending on available acreage, topography and natural

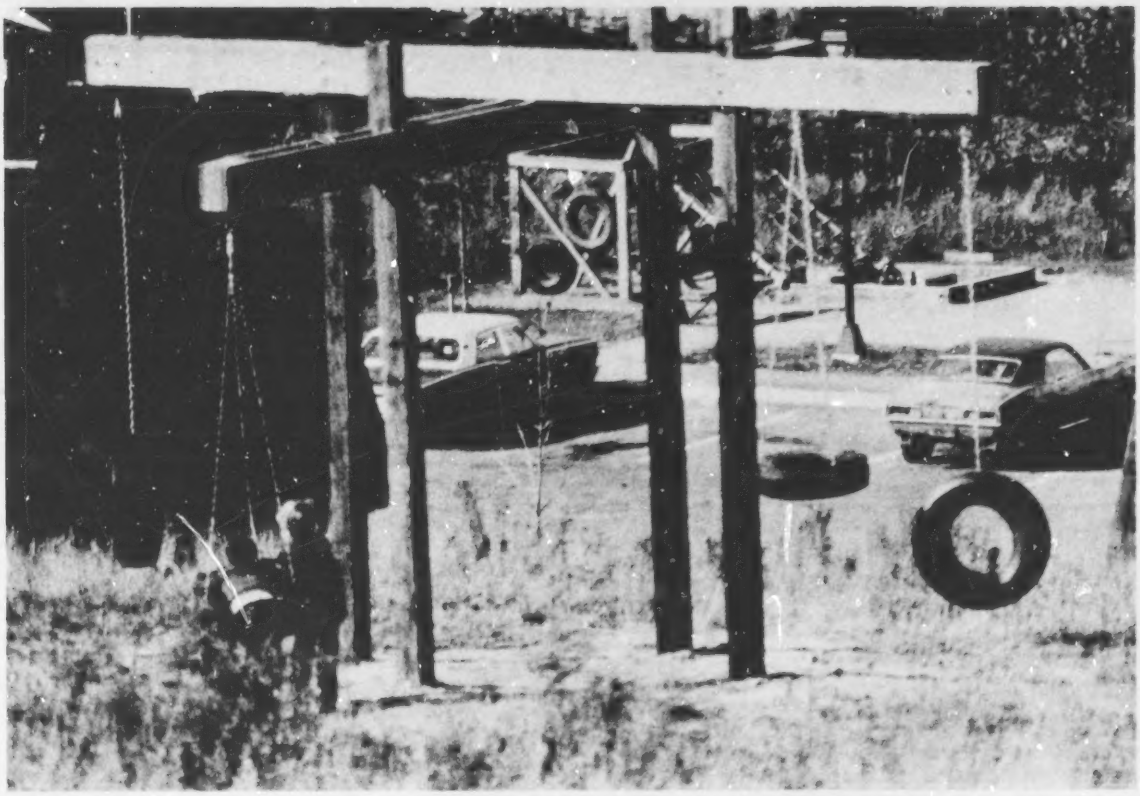


Figure 12
Neighborhood playground

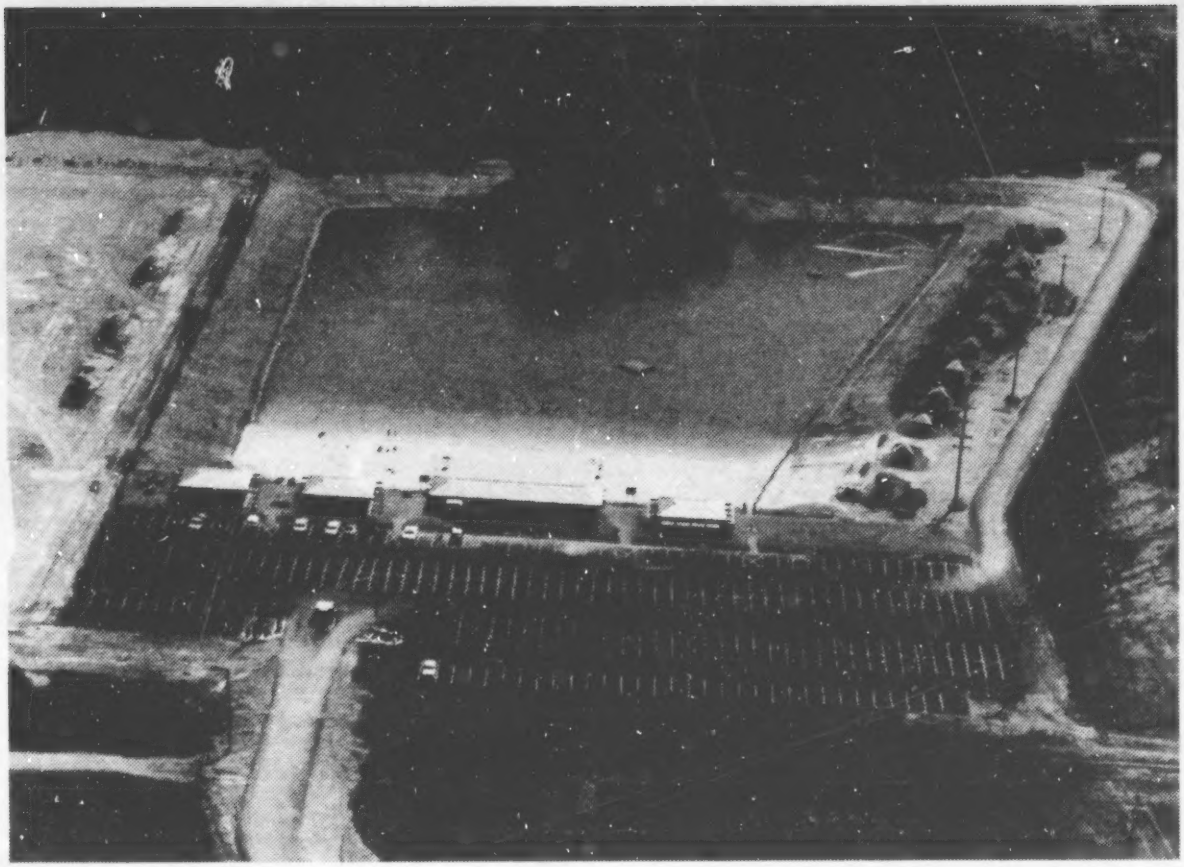


Figure 13

Man-made city park in Cortland, N. Y., features picnic areas, water sports lake, recreation building, nature trails and spacious parking area.

features, the city-wide or district park will contain a large number of different components. These would include, but not be limited to, the following:

- Field for baseball, football, soccer, and softball
- Tennis center
- Winter sports facilities
- Day-camp center
- Picnic areas (group and family)
- Cycling paths or tracks
- Swimming pool
- Water sports lake
- Pitch-and-putt golf course
- Recreational building
- Nature trails
- Skating rinks (ice and roller)
- Playlot and apparatus
- Parking areas
- Outdoor theater.

The above facilities should be separated by large turf and landscaped areas. Natural areas and perimeter buffers should be provided.

County and Regional Recreational Areas

County and regional parks are relatively large land areas intensively developed for recreational purposes and which supplement the facilities furnished by the urban parks and recreational areas. Natural surroundings and spaciousness are emphasized to a greater degree than in the large city park, although some county parks in rural counties have characteristics of the community park and playfield. County and regional parks are commonly used for day-long or weekend outings. They supplement the resources of nearby communities and provide opportunities to engage in a variety of activities requiring more space than most local parks afford. In some counties, consolidated or centralized schools provide facilities that serve not only school children but people of all ages.

A second type of regional area is the preserve or reservation, which generally consists of extensive land areas with relatively little development for recreation and with major emphasis upon the preservation of their natural, scenic qualities. Conservation areas, wildlife refuges, flood-control areas, and forest preserves fall into this category and are often accessible for recreation.

State and National Recreational Areas

The expansion of outdoor recreational activities and experiences has increased the significance of state and national facilities within reasonable access to urban centers. Campgrounds, picnic areas, and in some instances, sites ffor summer homes are provided in state and national forests and other federal properties. National recreation areas, sea-

shores, and waterways are more recent concepts within the national parks system. Recreational activities in these areas are broad in scope and geared to mass use.

Special-Use Areas and Facilities

Bicycle Facilities—Bikeways

Most of the recommended bicycle programs and facilities will require considerable investments of time and money to bring them to fruition. The development of bicycle paths through urban, residential and outdoor recreation areas will require costly investments that are not always available from public budgets.

An alternative program might be considered. This program would develop bicycle touring routes in and across the country, using rural and low volume vehicular routes (See Figure 14). The only expenses involved in the creation of this system are for initial system planning, printing bikeway maps, and marking intersections. County and city governments together with schools and universities have implemented touring systems.

Steps in the development of bicycling facilities:

- A committee appointed from interested groups of individuals, including representatives of the school or university and the recreation department.
- Make a survey of county road maps and mark a conceptual bicycle system on a work map. One of the objectives is to create a roughly circular route. "Spoke" routes would radiate from the campus to the peripheral route. Select the safest possible routes. High volume roads and intersections should be avoided. After the road map is finished, the committee should find that they have the framework for an adequate bicycle touring system.
- The next step involves field reconnaissance of the roads that have been marked on the working map. Alternate routes may be selected if the original roads are not appropriate for bicycling. Actual travel by bicycle is recommended for the reconnaissance.
- Following the completion of the field reconnaissance the next step is the drafting of the final bikeway map. Titles and safety information are also placed on the map. The back of the map may be filled with a variety of information. The bikeway should be marked, especially the abrupt turns. Marking may be done by painting distintive symbols and arrows on the pavement of the road. Standard highway marking paint may be used, and stencils for the symbols may be cut from heavy gauge linoleum.

Figure 15 offers a schematic of the bicycle facility planning process.

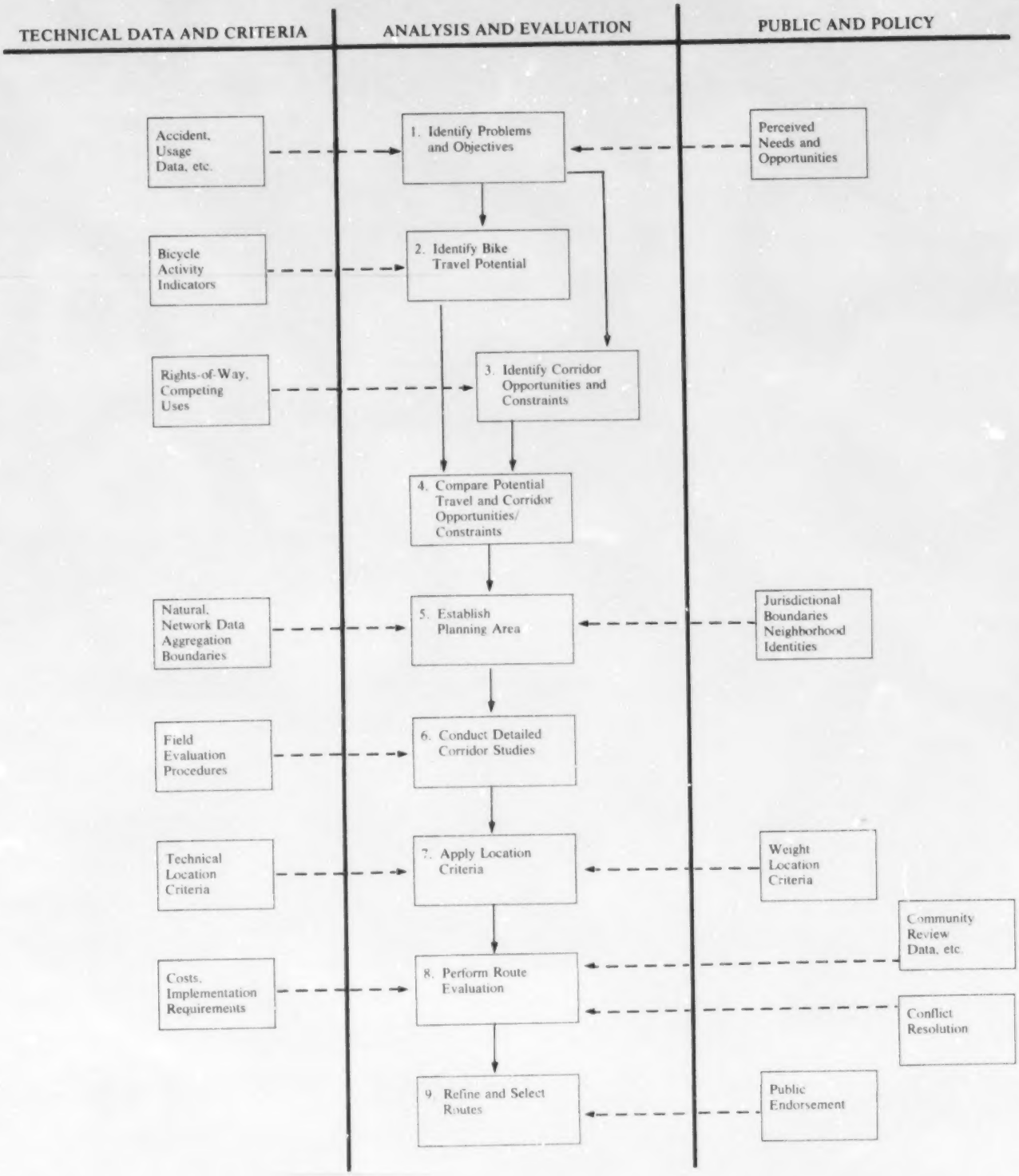
Bridle Paths and Rings

Horseback riding is popular with all age groups but is generally restricted to the larger park areas because of space requirements. Riding trails are usually a minimum of 10 feet wide to permit riders going in opposite directions to pass in safety. Except on very steep terrain, very little is required in the way of construction. Clearing, a small amount of leveling, removal of large rocks and boulders, and trimming or removal of low-hanging tree limbs constitute the major items. Most small streams can be forded, but an occasional bridge may be required as well as cross drainage on steep gradients. No special surfacing is required except that a gravel base may be

Figure 14

Opening of a bike trail through the combined efforts of Middle State Tennessee University, Murfreesboro, Tenn., and Rutherford County, Tenn.

Figure 15
Bicycle facility planning process


TECHNICAL DATA AND CRITERIA
ANALYSIS AND EVALUATION
PUBLIC AND POLICY
Accident, Usage Data, etc.
1. Identify Problems and Objectives
Perceived Needs and Opportunities
Bicycle Activity Indicators
2. Identify Bike Travel Potential
Rights-of-Way, Competing Uses
3. Identify Corridor Opportunities and Constraints
4. Compare Potential Travel and Corridor Opportunities/ Constraints
Natural, Network Data Aggregation Boundaries
5. Establish Planning Area
Jurisdictional Boundaries Neighborhood Identities
Field Evaluation Procedures
6. Conduct Detailed Corridor Studies
Technical Location Criteria
7. Apply Location Criteria
Weight Location Criteria
Community Review Data, etc.
Costs, Implementation Requirements
8. Perform Route Evaluation
Conflict Resolution
9. Refine and Select Routes
Public Endorsement

Source: National Recreation and Parks Association (*"Trends," Vol. 15, No. 3*)

needed in wet or boggy areas that cannot be avoided. Tanbark, cinders, and other materials are also used frequently on heavily used trails and in areas of concentrated use around hitching racks and in riding rings.

Stables and adjoining facilities, such as feed racks, holding corrals, riding rings, and hitching racks, should be located at least 500 feet from the nearest public-use area because of the fly and odor problem. The size of these facilities will, of course, depend on the number of horses. However, the stable will ordinarily contain a limited number of horse stalls, a feed-storage room, a tack room, a small office, and toilet facilities for men and women. A fenced enclosure, commonly called a holding corral or paddock, into which the horses can be turned at the end of the day is required. A surfaced riding ring sometimes encircled with a rail fence, is frequently provided for training novices in the fundamentals of riding. For dimensions of show rings, see Figure 16.

Exercise Trail

The physical fitness boom of the 1970's has inspired a unique total body conditioning program—exercise trails. Marketed commercially as Fitness Trail, Fit-Trail, Lifecourse, and Parcourse, the trail combines cardiovascular development, agility, flexibility, strength, and endurance.

The exercise trail consists of a number of exercise stations located at various lengths along a jogging course. A typical trail could have a 1.5-mile distance with 13 exercise stations. The running intervals and exercises are designed for flexibility, agility, strength, and flexibility progression, all the while developing the participant's cardiovascular system. (See Figure 17).

Orienteering

Outdoor enthusiasts use compass directions to guide them in exploring new terrain, One of the ultimate uses for compass directions is in the fast-growing sport of competitive orienteering. The sport of competitive orienteering involves finding one's way with a map and compass along an unknown stretch of ground to one's pre-selected destination.

For whatever the reason—sport exercise, nature study, or just to enjoy the quiet beauty of the wilderness—orienteering provides the means by which one can navigate.

Alpine Slide

The Alpine Slide is one answer to the ski area operators biggest problem—summer. The Alpine Slide, a popular and successful form in both the United States and Canada. The Slide provides an ideal means of using mountain areas, especially ski resorts with all their existing facilities, in a way that is designed to be compatible with the environment (See Figure 19).

Golf Courses

The design, construction, operation, and maintenance of golf courses is too vast a subject to be covered in detail in this publication. For general information and guidance, write the National Golf Foundation at 200 Castlewood Road, North Palm Beach, Florida 33403.

Assuming the land is suitable for construction of a golf course, the following space requirements must be taken into consideration:

- For a standard 18-hole course -- 120 - 160 acres
- For a standard 9-hole course -- 70 - 90 acres
- For a 9-hole par three course (including a couple of par four holes -- 45 - 60 acres.

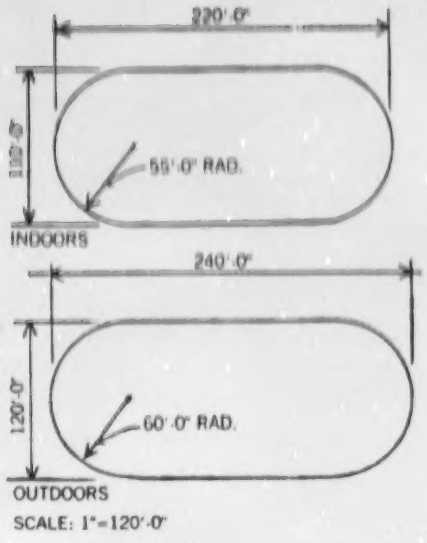


Figure 16
Horse show rings

The planning should provide also for and administrative clubhouse, a practice putting green and a practice driving range.

Marinas

America abounds in waterways. The myriad of inland lakes, the rivers and streams, the vast Great Lakes, and the thousands of miles of coastline serve to invite America's citizens to take advantage of this natural resource. Today, boating commands more of the recreational dollar than baseball, fishing, golf, or any other single activity. There is a need for efficient, realistic, and functional planning for facilities to accommodate the present needs and the future growth that this recreational interest will precipitate.

The launching, mooring, and storage of yachts and rowboats are the function of a marina that will serve the needs of the recreational-boat owner (See Figure 20).

Size and Scope

It is suggested that knowledgeable and experienced personnel be engaged to conduct a study of the number, types, and sizes of existing boats in the area, the number and size of existing berthing facilities, and the condition of such existing facilities. The survey should also include the potential population growth in the community and surrounding area to determine the future boat ownership. An accurate and comprehensive evaluation of such a study is the first step in planning a marina.

The data from the study will determine the next important consideration in laying out a marina: choosing the correct number of slips of each size that will be required. Based on the needs of the community to be served, planners will determine the necessary number of slips to accommodate boats of various sized.

Because marinas vary so greatly in their design, function, location, and capacity, it is virtually impossible to arrive at standard conclusions and judgments concerning a model marina. Each planner will be able to apply the general principles to his unique circumstances. From that point, however, he must adapt his marina to the peculiar needs and characteristics of his community.

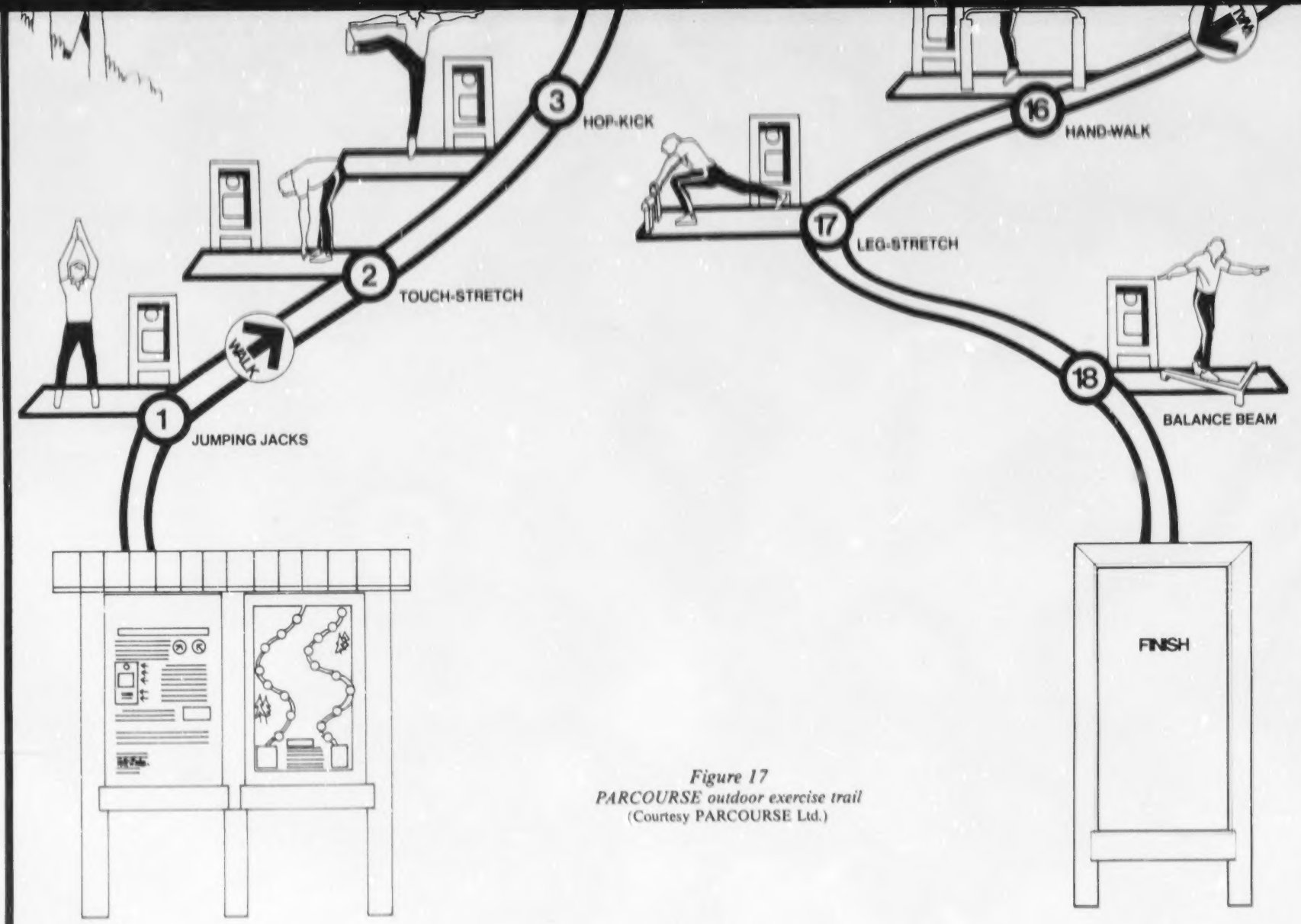


Figure 17
PARCOURSE outdoor exercise trail
(Courtesy PARCOURSE Ltd.)

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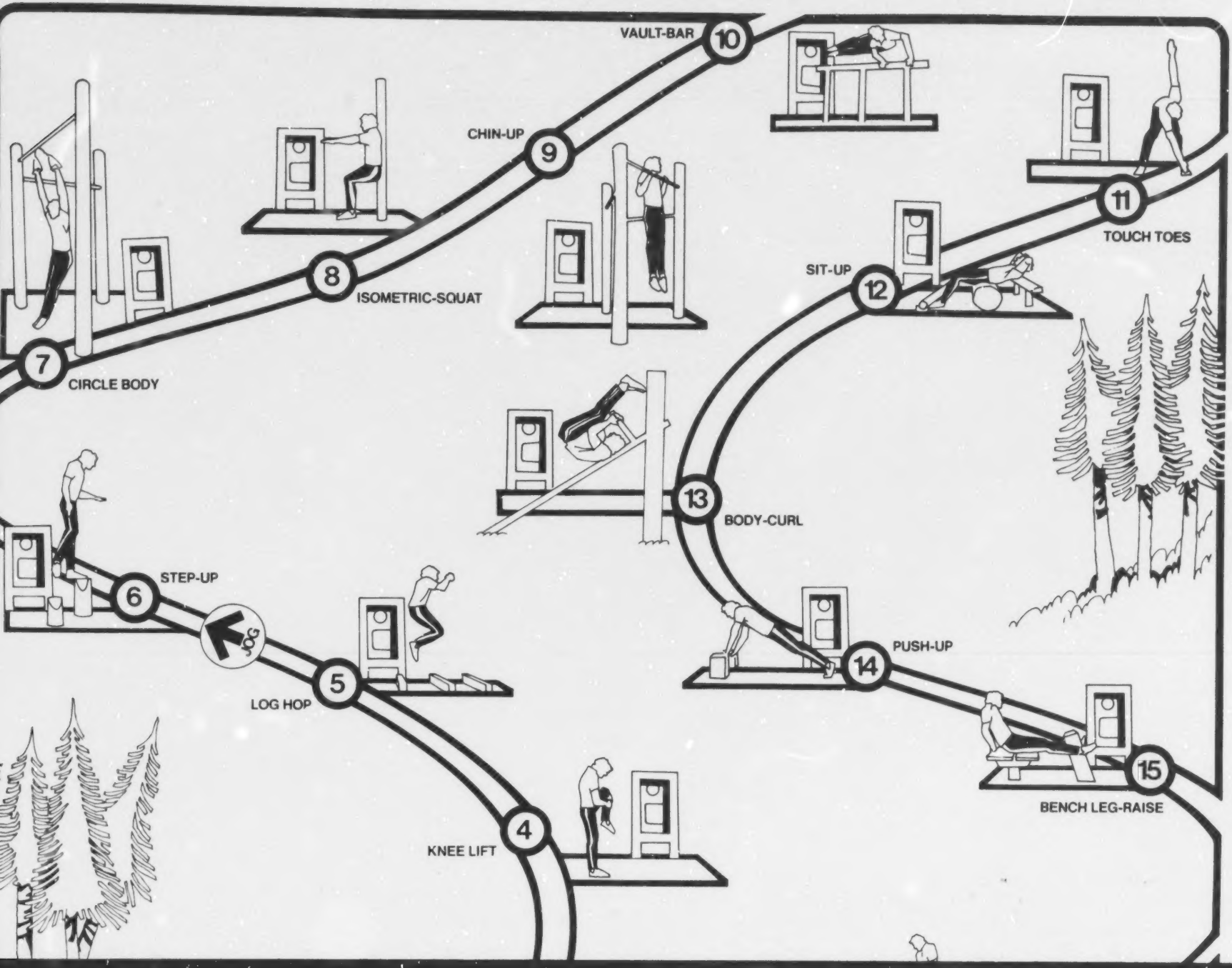

VAULT-BAR
10
CHIN-UP
9
8
ISOMETRIC-SQUAT
7
CIRCLE BODY
11
TOUCH TOES
SIT-UP
12
13
BODY-CURL
STEP-UP
6
5
LOG HOP
PUSH-UP
14
15
BENCH LEG-RAISE
KNEE LIFT
4

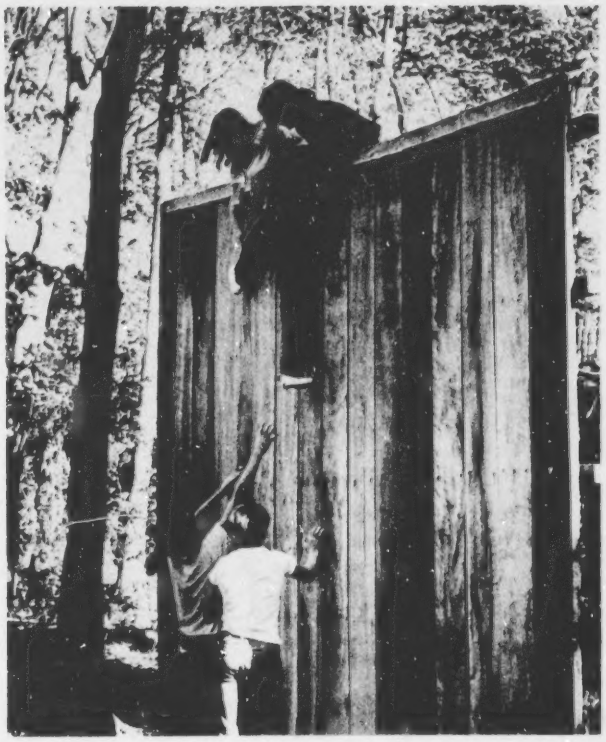


Figure 18
Exercise stations

Roller Skating

Roller skating may be permitted on a multipurpose area or on sidewalks and streets under proper safety controls. If a rink is built, it is suggested that the area by 100 by 200 feet. A track for speed skating can encircle the figure or leisure skating area. The track should be banked at the curves, and the interior should be slightly pitched for drainage. Boundaries of the track should be defined with flags, wooden blocks, or pylons. Mark each turn with pylons, and indicate the starting and finish lines. The rinks should be oriented so that skaters travel in a north-and-south direction.

The surface should be smooth wood (wide) or concrete sprinkled with rosin or a similar substance. If the areas for skating are speed rinks or multi-purpose areas, they should be fenced for safety and control.

Ice Skating

Ice-skating facilities are feeling the impact of modern technology in more and more communities each year. With the advent of mechanical freezing, the skating season has been extended from a 20- to 60-day average season to a 140-day season and, depending on climatic conditions, to as much as 240 days.

While natural-ice rinks have not gone out of style, artificial rinks are replacing them as central or regional facilities. Natural-ice rinks are continuing to serve as a supplemental neighborhood facility in many communities. A considerable number of skaters still prefer the rugged pleasure of an old-fashioned skating experience.

Ice Hockey

Ice rinks may have a sport function as well as providing a recreational service. If ice hockey is to be part of the rink's activity schedule, goals will be needed and a four-foot high solid fence, called the dasher, will have to be installed to enclose an area as near 85 by 185 feet as possible. Dasher boards are heavily reinforced to stand the shock of players being pushed against them and are lined on the rink side with either wood or plastic. There is normally a chain link or clear plastic barrier another four to six feet on top of the dashers to enable spectators to view games safely. The dasher board enclosure should have round corners, because square corners present a hazard. A kick board, six or eight wide, is fastened at the base of the dasher boards and is replaced as often as necessary.

Because dasher boards reflect sunlight and cause melting of the ice, they should be painted a dark color. However, it is difficult to follow the puck if the dasher boards are too dark, so a shade of grey is recommended. If the hockey rink is indoors, the dasher boards can be painted a light color without causing a melting problem.

Information describing the complete ice arena is included in Chapter 5.

Curling

Curling is a popular ice sport. Sponsored by clubs and leagues, it is played with a hand-propelled 35- to 38-pound stone. There are four members on a team, with two stones. The object is to place one's stone nearest the mark. For a diagram of a rink laid out for curling, see Figure 23.

Performing Arts Areas

In the past few years there has been increased demand for

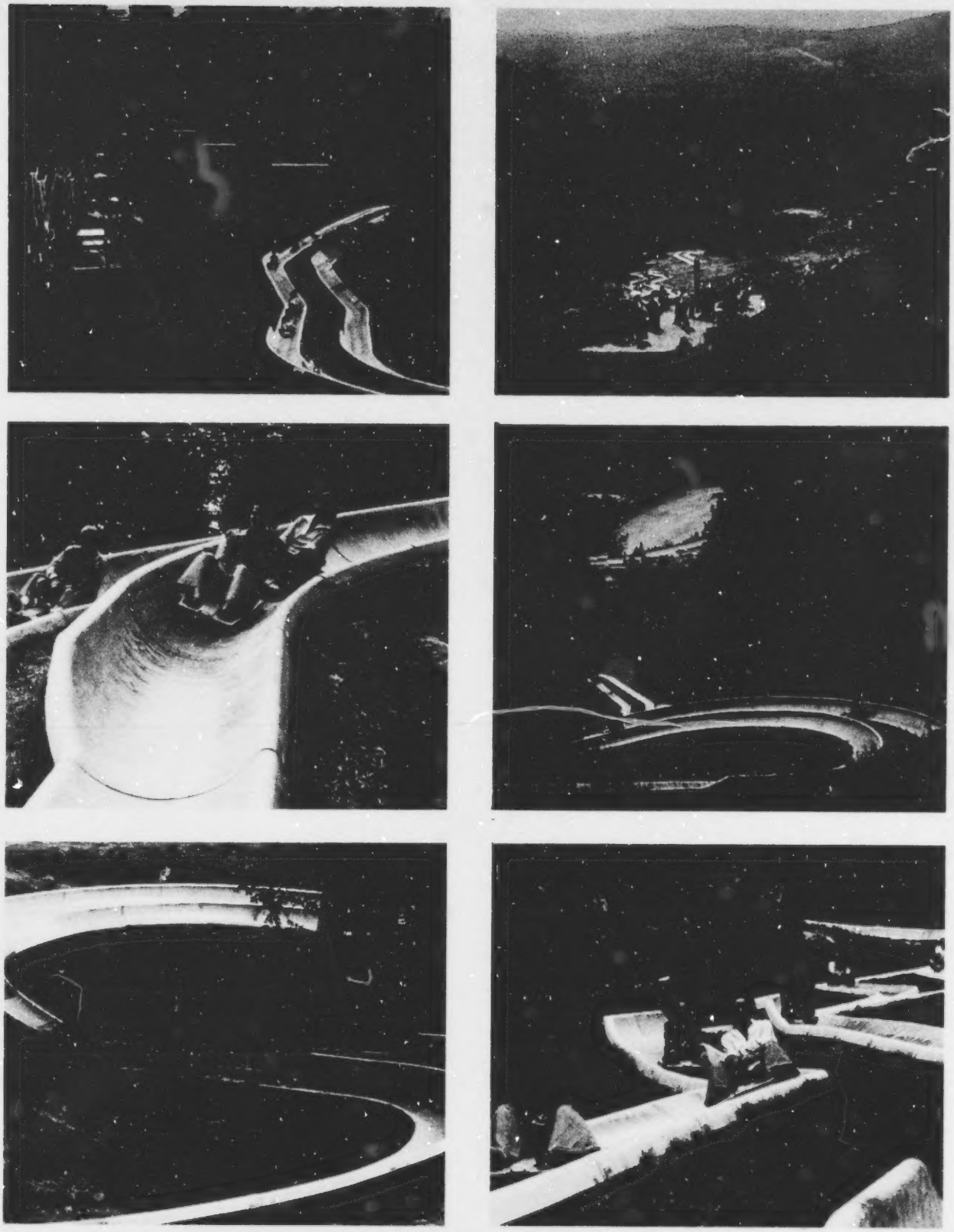


Figure 19

The big thrill — riding the Alpine Slide at Bromley, Vt. Riders can control their speed as they travel the 4060-foot downhill run on plastic sleds through dual cement flumes.

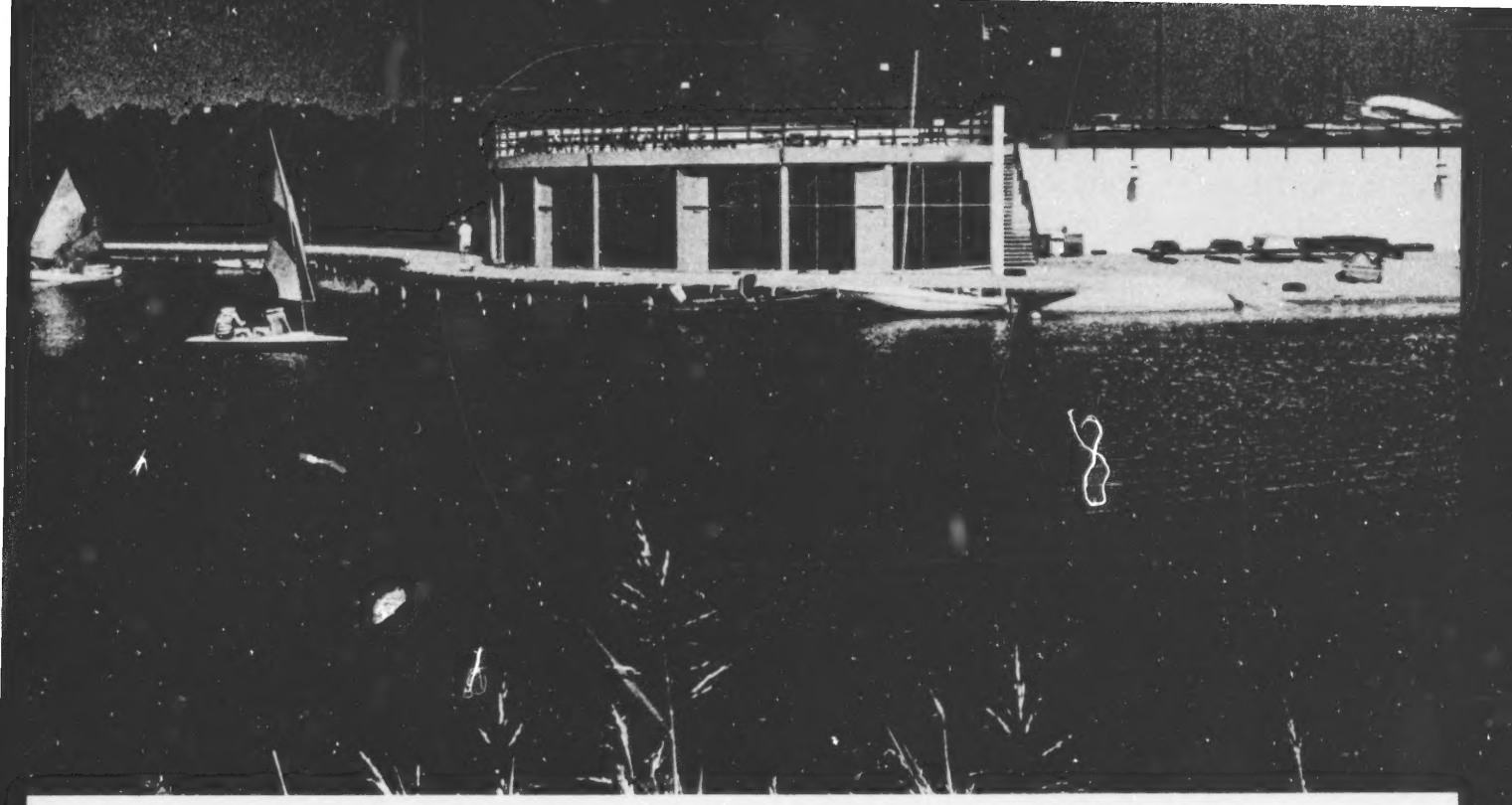


Figure 20
Baylor University Marina is used for instruction during the day and is open for recreational use in the afternoon and evening

suitable indoor and outdoor facilities for operas, plays, band and orchestral concerts, pageants, festivals, holiday programs, and civic celebrations. When performed outdoors, such activities usually require a stage or band shell with adjoining amphitheater capable of accommodating large numbers of spectators.

Selection of the proper site for an outdoor theater is of primary importance. It should have good acoustic properties and be located in a quiet place away from the noise of traffic or of groups at play. A natural bowl or depression on a hillside with a slope of 10 to 20 degrees, preferably bordered by slopes or densely wooded areas, provides a fine location.

At some theaters, people sit on the slope of the amphitheater. At others, permanent seats are installed. Terraces with a turf surface are not recommended because they are too difficult to maintain. Sufficient level space should be provided at the rear of the seating area for the circulation of spectators, and aisles should be wide enough to facilitate the seating of large numbers in a short period of time. Public comfort stations and refreshment facilities are usually provided near the entrance to the amphitheater. Provision for the nearby parking of automobiles is essential, but parking areas must be located where noises and car lights do not disturb the stage action.

The dimensions of the stage are determined by the proposed uses, but rarely should a stage be less than 50 feet in width or 30 feet in depth. The rear of the stage may be a wall or high hedge, or even a planting of trees, and the wings may be formed by natural plant materials. The band or music shell, however, is more satisfactory for projecting voices and sound free from echoes and interference. A vertical rear wall with inclined ceiling is not only the simplest and most economical to construct, but affords excellent acoustic qualities.

The band shell usually contains dressing rooms, toilets, storage space, and control centers for amplifying and lighting equipment, although sometimes these facilities are provided in separate structures near the back of the stage. An orchestra pit is generally located between the auditorium and the stage.

Mobile stage units with self-contained lighting and acoustic systems are becoming very popular today because they can be used in many parks instead of restricting programs to one permanent location. Equipped to serve as a band shell, stage, puppet theater, or platform for other performing arts, these mobile units can bring productions to new audiences never exposed to such activities. Excellent units can be obtained at a cost less than that required for a permanent band shell.

Shooting Sports Facilities

Shooting sports, once confined to private membership clubs, have gained in popularity as a part of municipal recreation programs. The type of needed facility varies with the particular sport, and requires technical advice from specialists for each type of range. Many organizations offer such service and a listing appears in this section.

NOTES:

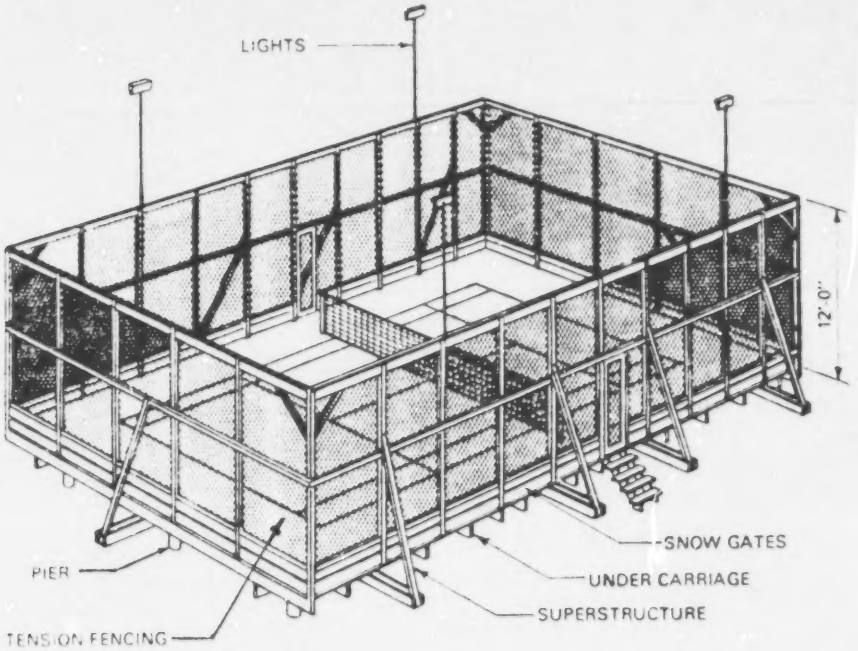
All measurements for court markings are to the outside of lines except for those involving the center service line, which is equally divided between right and left service court.

All court markings to be 2" wide.

Fencing required - 12'-0" high with 16-gauge hexagonal, galvanized 1" flat wire mesh fabric.

For net post details see manufacturers' literature.

Net height to be 3'-1" at posts and 2'-10" at center court.



ISOMETRIC SHOWING FENCE (TYPICAL WOOD CONSTRUCTION)

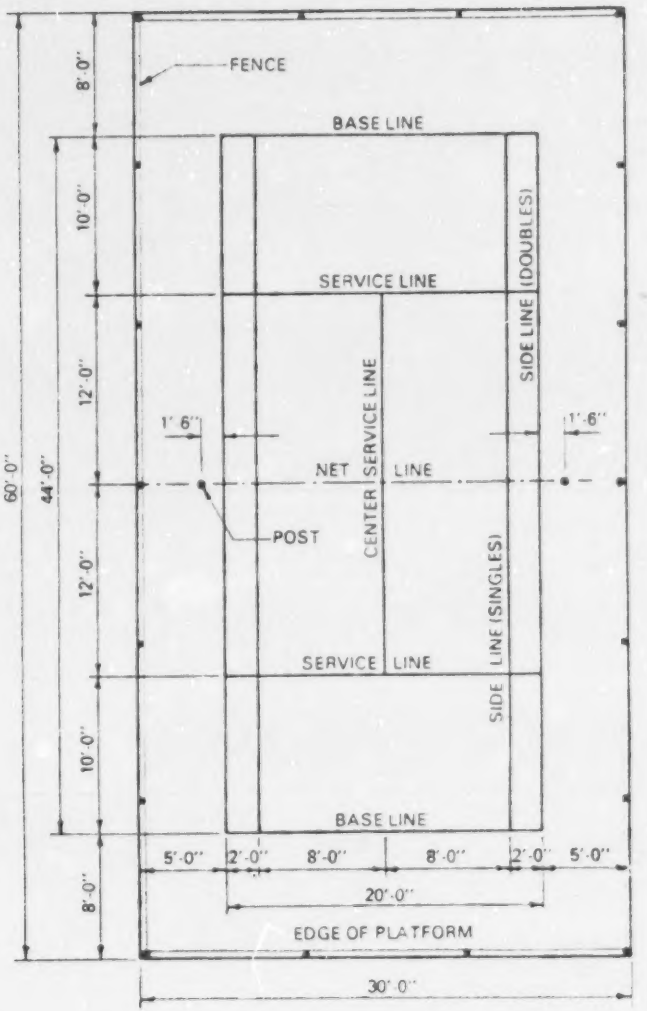


Figure 21
Platform tennis layout

182

83

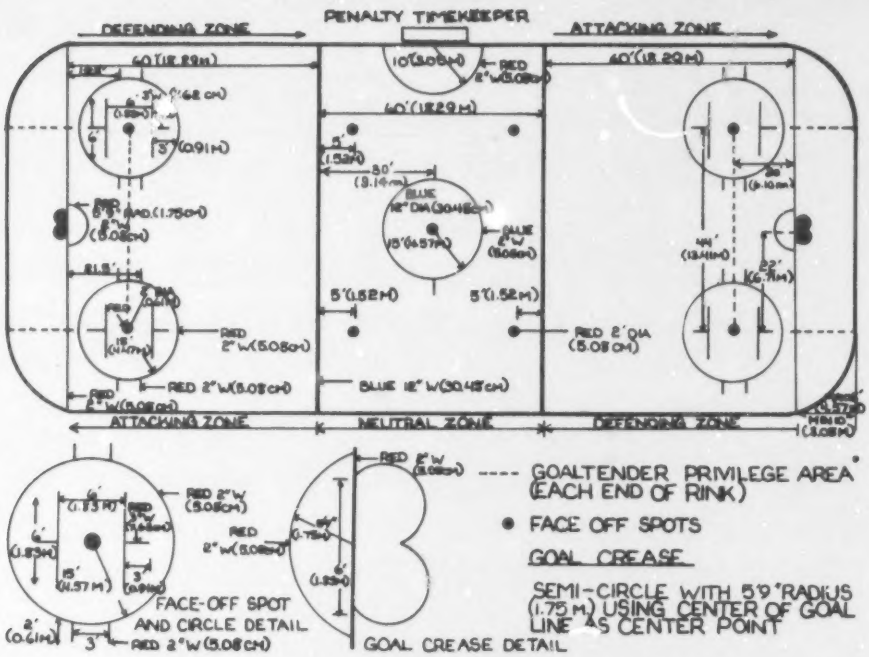


Figure 22
Ice Hockey (from NCAA Ice Hockey Guide)

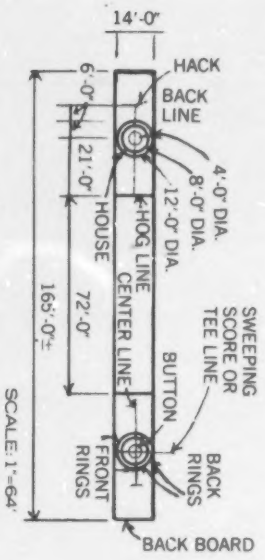


Figure 23
Curling

Trap and Skeet Ranges

Ranges for safe and effective conduct of shotgun sports require considerable land located in a sufficiently remote area where associated noise will not be objectionable. The amount of needed land will vary in accordance with topography and location. For Skeet, 29 acres should be allowed for single field with 2 additional acres for the shotfall danger zone (Figure 24). For Trap (Figure 25), 16 acres should be allowed for a single field with 3 additional acres required for the shotfall danger zone (Figure 25).

Preferred orientation for the center line of both Skeet and Trap fields is northeast-southwest with the shooter facing northeast. Each sport may have shooting stations constructed of concrete, with the shooting area and a 100-yard radius minimum cleared area to be turf. The recommended 300-yard radius shotfall zone may be turf, water or left in a natural state, and the entire range should be located on a relatively flat area with an open background. Posting of warning signs and appropriate fencing should be provided for safety.

Combination ranges are sometimes built which superimpose a Trap range and a Skeet range on the same area (Figure 26). While this saves space, it does preclude the use of both facilities at the same time.

Sources of Assistance for Planning and Construction

Planning of all shooting sports facilities necessitates greater consideration of safety factors than any other sport. The assistance of professionals from the shooting sports industry and organizations is essential in planning and development. Listed below are sources which offer information regarding construction of facilities.

National Shooting Sports Foundation
1075 Post Road
Riverside, CT 06878

National Skeet Shooting Association
P.O. Box 28188
San Antonio, TX 78228

Amateur Trapshooting Association
Vandalia, Ohio 45377

National Rifle Association
1600 Rhode Island Ave., N.W.
Washington, D.C. 20036

Remington Arms Co.
939 Barnum Ave.
Bridgeport, CT 06602

Winchester-Western Co.
275 Winchester Ave.
New Haven, CT 06504

Outdoor Rifle Ranges

Small bore outdoor rifle ranges require shooting distances of 300 feet for maximum effectiveness, though shorter distances can be used. Distances between firing points and behind the shooting area should be at least as great as those in an indoor range, and greater, if possible. Backstops may be made of steel plate or earthern construction, but must be effective in stopping bullets safely. A remote area is preferable for the location of the range for maximum safety.

Ranges for high powered rifles required firing lines at 200,

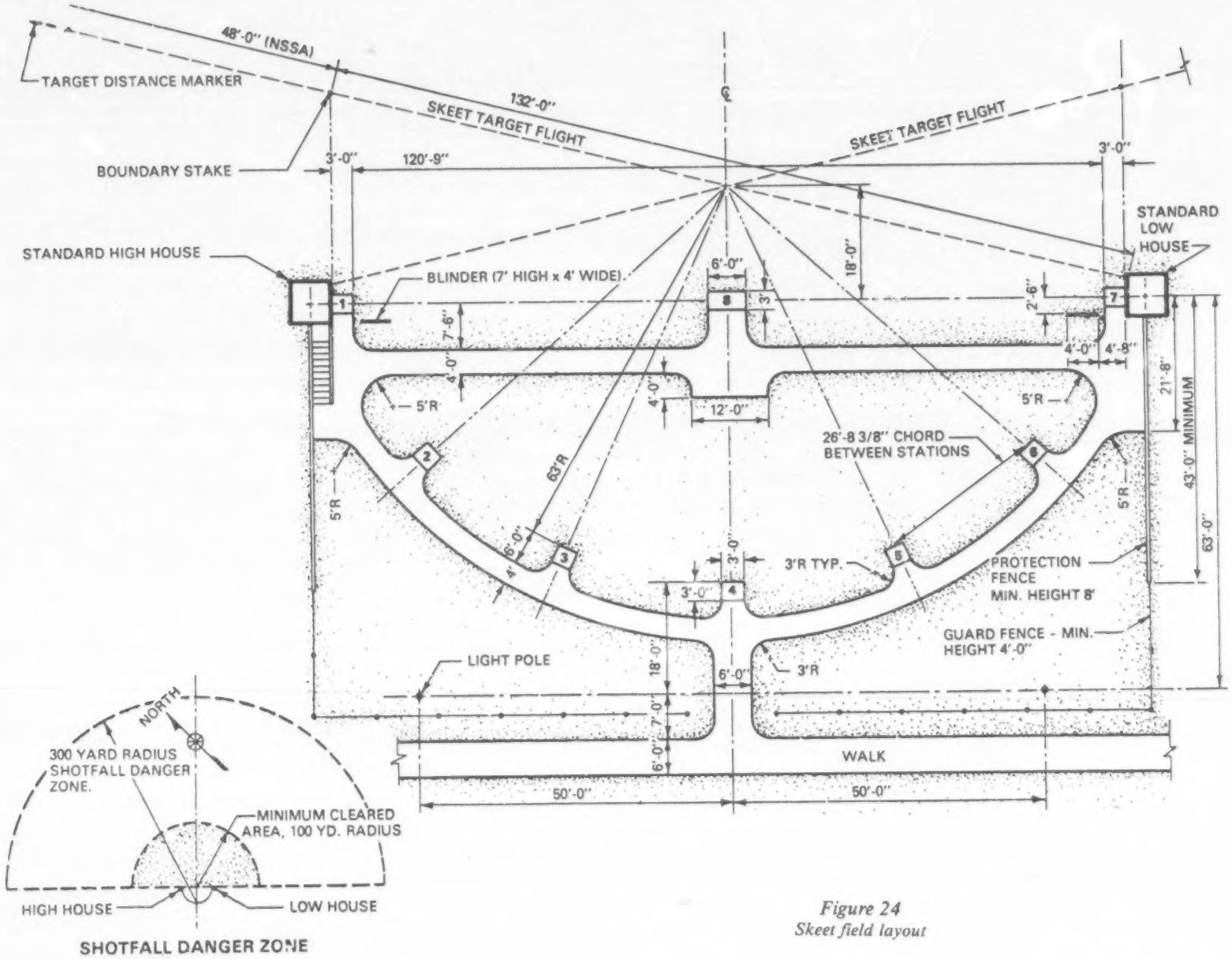


Figure 24
Skeet field layout

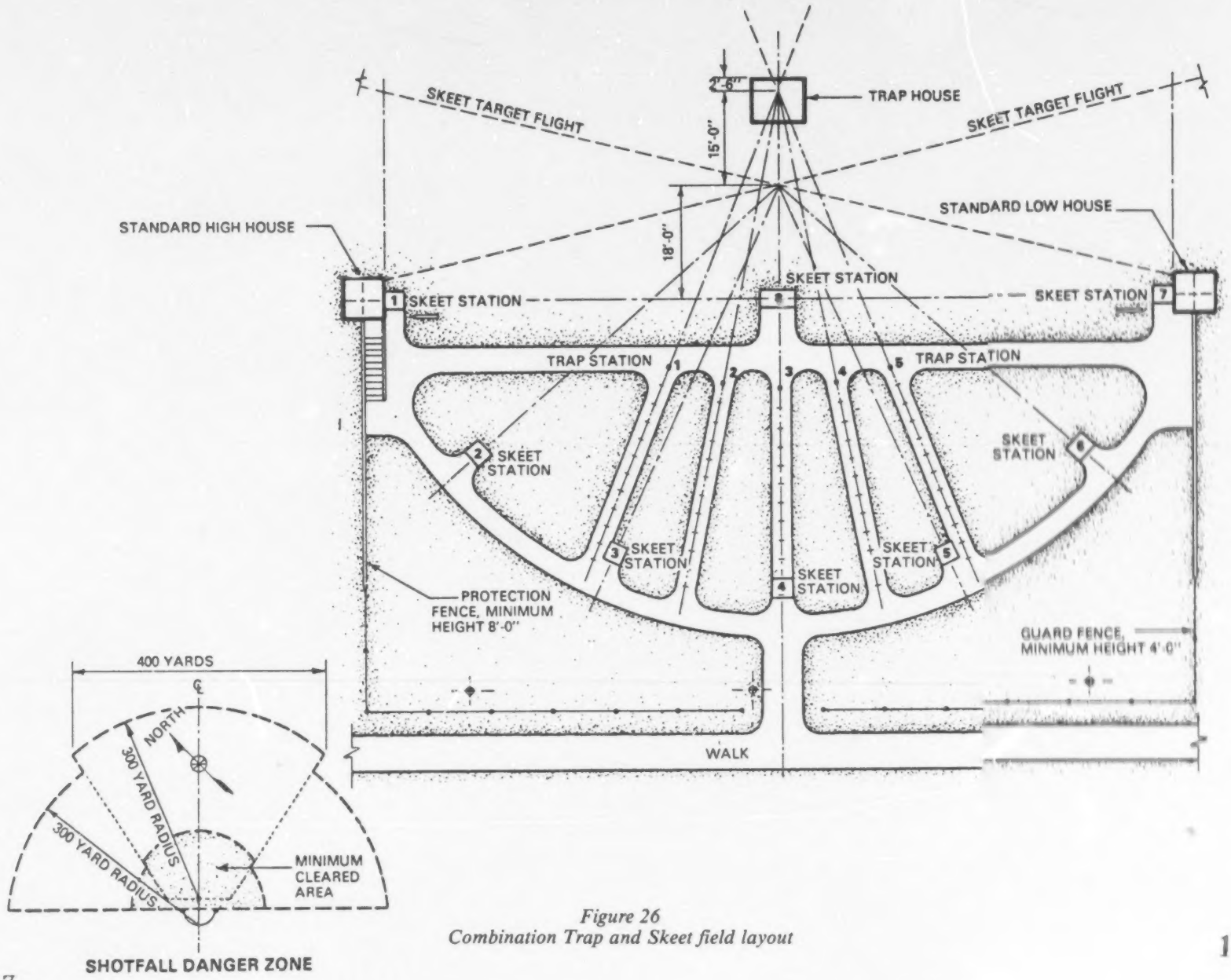


Figure 26
Combination Trap and Skeet field layout

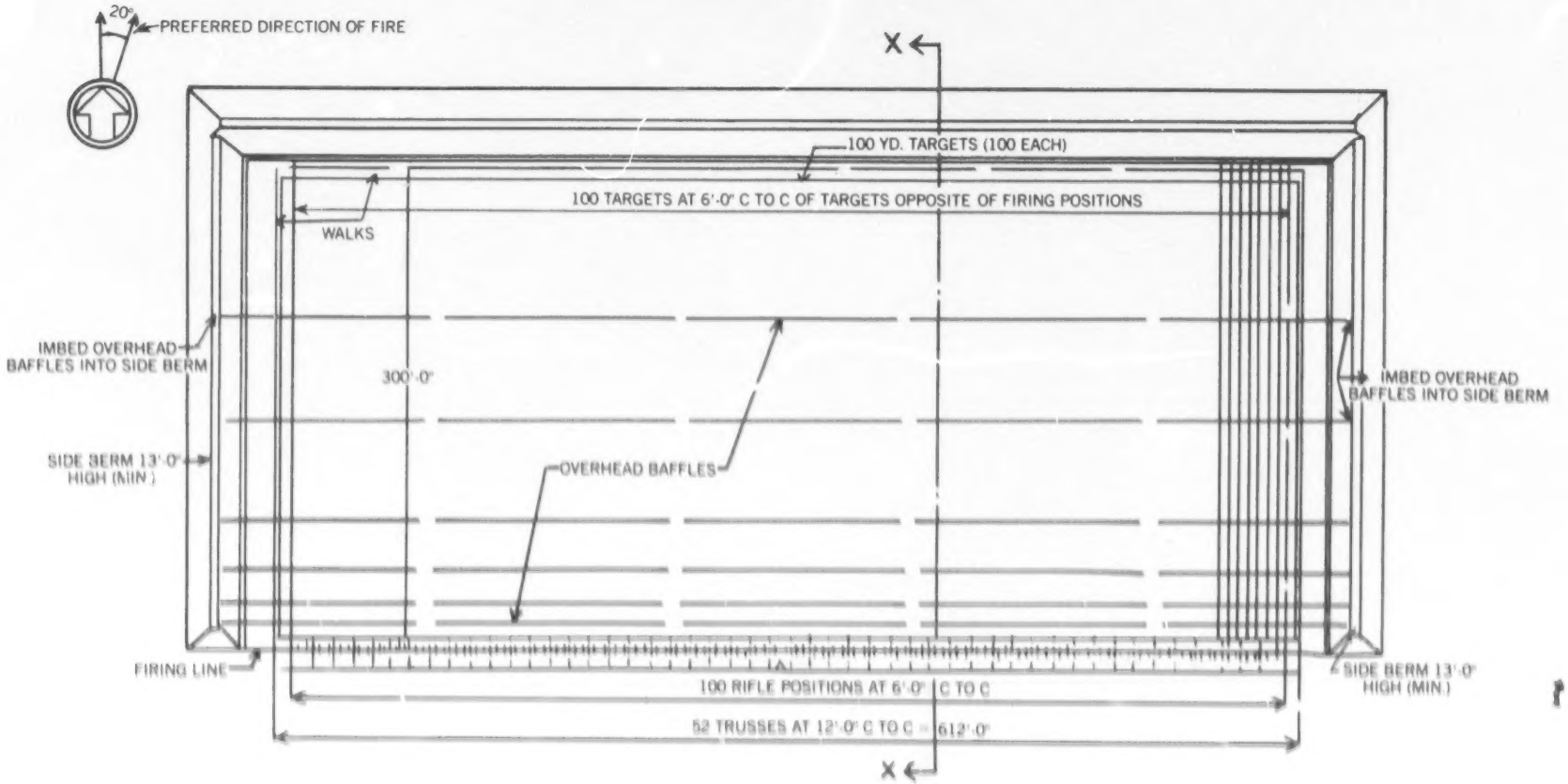
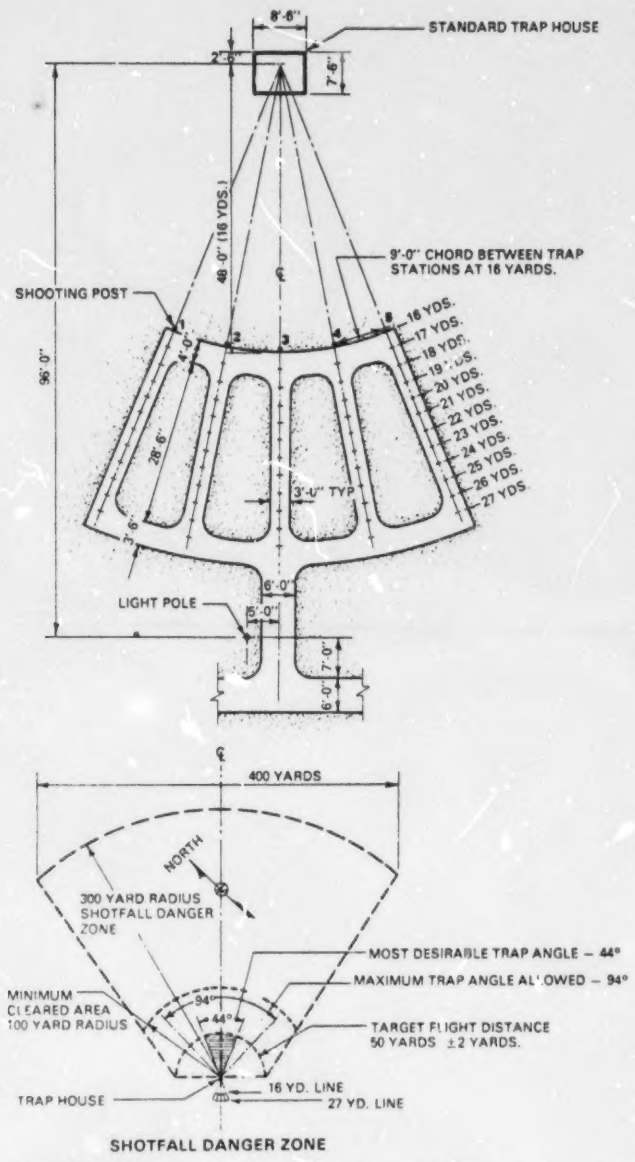

20°
PREFERRED DIRECTION OF FIRE
X
100 YD. TARGETS (100 EACH)
100 TARGETS AT 6'-0" C TO C OF TARGETS OPPOSITE OF FIRING POSITIONS
WALKS
IMBED OVERHEAD BAFFLES INTO SIDE BERM
300'-0"
IMBED OVERHEAD BAFFLES INTO SIDE BERM
SIDE BERM 13'-0" HIGH (MIN.)
OVERHEAD BAFFLES
FIRING LINE
SIDE BERM 13'-0" HIGH (MIN.)
100 RIFLE POSITIONS AT 6'-0" C TO C
52 TRUSSES AT 12'-0" C TO C = 612'-0"
X

Figure 27
Small bore rifle and carbine range

Figure 25
Trap field layout



300, 600, 800, and 1,000 yards. Safety requirements demand large amounts of space, and the design and development of such a specialized facility requires the services of a consultant.

The indoor rifle range is discussed in Chapter 3.

Archery Range (Recreational)

This sport appeals to a sizable group in most communities. Sufficient space is needed to ensure the safety and enjoyment of the participants.

The range should provide shooting distances of 100, 80, 60, 50, 40, and 30 yards. For junior use, target ranges can be from 10 to 50 yards. Targets are 48 inches wide and should be at least 15 feet apart. Generally, the target line is fixed and varying shooting lines are used. The side boundaries should extend 10 yards beyond each end of the range.

In the interest of safety, additional space should be provided beyond the target, free from stones and other substances that might cause the breakage of arrows falling wide of their mark. This space may be protected by an earth bunker or bales of hay and straw piled up to the top of the target.

An archery ranges should be fairly level. Orientation should be north and south so the archers will not be facing the sun. A fence enclosure is desirable but not essential. The public should be controlled in some manner, however, so they do not walk through the range.

Storage sheds for butts and other equipment are sometimes a part of the archery range. Some storage rooms have been placed within the earth bunker behind the targets.

So the facility may be used by the disabled, it is desirable to design a four-foot wide, ground-level, hard-surface walk for wheelchair use along the shooting lines. Another walk could extend to the target line (preferably down the center) and perhaps another walkway behind the targets to provide access for extracting arrows. Such walks reduce interference from inclement weather, increase the use of the range, and reduce maintenance costs.

Field archery is a simulation of actual shooting conditions in the field. Up to 28 targets are used on the field course. The site selected for such a course should be heavily wooded and have rolling terrain. It should be fairly well isolated or in an area that can be controlled so the general public will not intrude.

Targets should be mounted on built-up banks or on the side of a hill. Each target has various pins (shooting positions). The farthest target is 80 yards and the nearest is 30. The target should simulate either animals or concentric circles. The size is dependent upon the distance from the target. The scoring is similar to that for golf—the score is totaled for each target, the grand total giving the score for the complete round.

Clout shooting requires a variation in target size and arrangement. The target face is marked on the ground with white lines. The size of the target is enlarged so that one inch on a regular 48-inch target would equal 12 inches on the ground. The center of the bull's-eye must be indicated by a single-color flag. The range for men is 180 yards; for women and juniors, 120 yards.

The field dimensions for flight shooting are approximately 200 by 600 yards. The field should be roped off on all sides except that from which the archers shoot. A distance of not less than 10 yards behind the shooting line is reserved for the flight shooting space. Officially, the flight must be from a series of colored or numbered pegs set in the ground, usually about six feet apart.

Figures 28 and 29 depict a sample outdoor archery range lay-out and target details. Additional information regarding archery is included in Chapters 2 and 3.

Snow Sports

Ski Courses

Skiing has become very popular in the past few years. If climatic conditions are suitable and desirable topographic features available, a school or a park and recreation department should look into the possibility of developing the facilities needed to foster this sport.

The provision of skiing in a school or public recreational system should be approached from an instructional standpoint, the theory being to give participants some basic instruction in the sport so they can enjoy it as a leisure-time activity in the resort areas that have more ideal facilities. If the park system contains ideal skiing hills with plenty of room, regular ski courses may be developed. Some of the

NOTES:

Space behind and to either side of the range to be clear and free from hard objects.

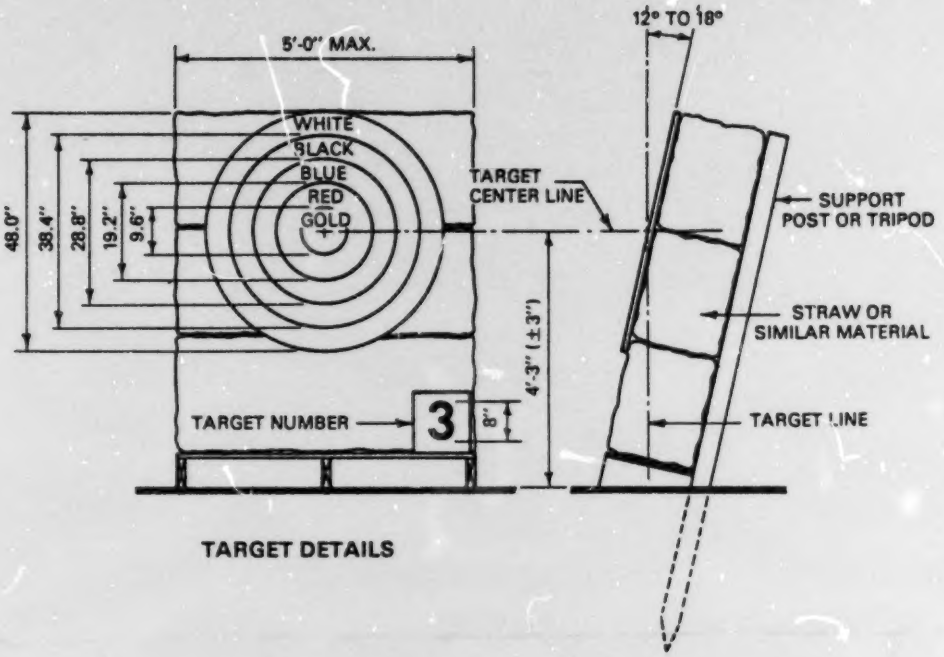
Background behind targets to be preferably dense trees, natural or manmade hills or protective shields.

Range to be sited on fairly level land, free from obstructions, preferably sheltered from high winds and oriented to north ± 45°.

Standard rounds for adults, 30 - 100 yards.

Standard rounds for juniors, 20 - 50 yards.

Target may be mounted on a round butt of spirally sewn straw or rush supported by a portable soft wood target stand. Colors may be painted on an oilcloth cover.



TARGET DETAILS

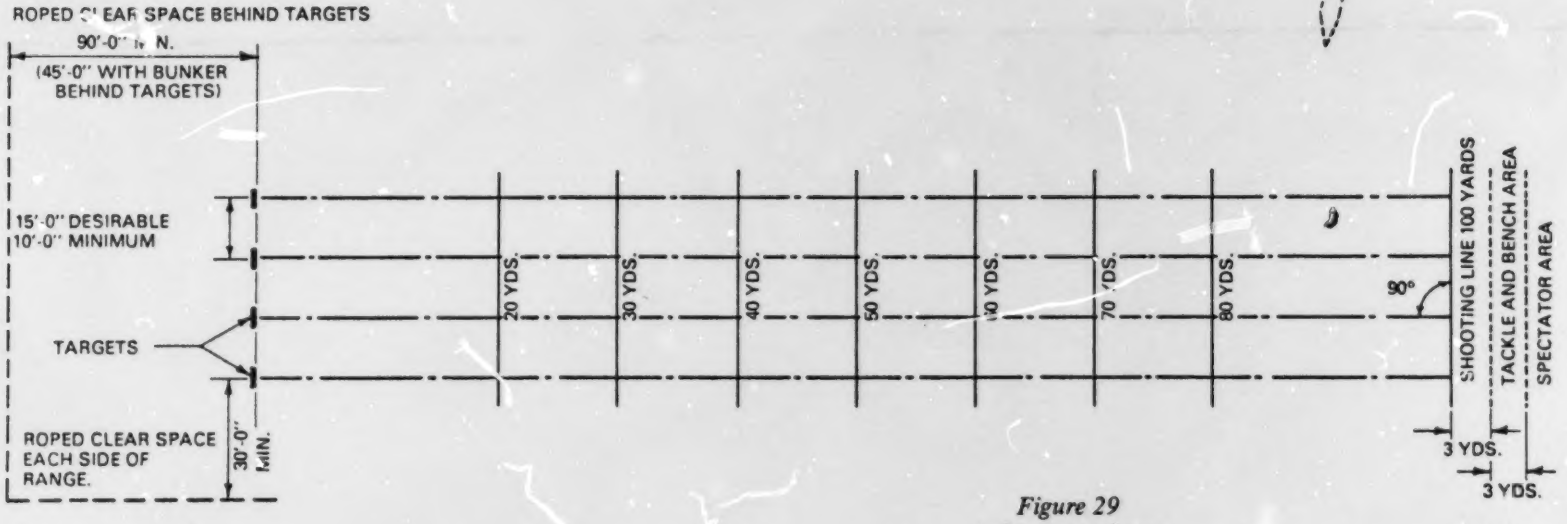


Figure 29
Archery range layout

basic facilities required for skiing instruction include proper topographical features; a headquarters building to be used for rental of equipment, a refractory, and similar purposes; a ski tow; and various slopes for instructional purposes.

Normally, the series of classes is broken into three units—beginners, advanced, and expert. It is the opinion of ski instructors that the beginners' ski class is by far the most important for recreational skiing.

Basic instruction in skiing may be conducted in classes not exceeding 25 to 30 beginners. For this group, a gentle and short slope with a relatively large flat run-out area is desirable because it permits a beginner to have complete control of himself and allows him to gain confidence in the use of his skis. In the advanced group classes are much smaller, and in the expert group, instruction becomes almost individual. For each successive group, hills become longer and a little steeper.

Beginners' Classes. The following criteria are recommended for the selection of facilities for beginners' classes:

- Flat-top hill area, 50 square feet per skier, 25 skiers per class
- Slope about 75 feet to 100 feet long, drop in grade of 15 feet, or 4:1 ratio
- Starting line at top of slope, 100 feet wide
- Run-out at bottom of slope either flat or uphill
- Slope facing east or northeast
- Instructional area free of stones, woods, and other impediments
- Protective cover, such as trees or brush, around the area.

Advanced Classes. The following criteria are suggested for advanced classes:

- Top of hill about the same as for beginners
- Slope is most important: ratio about 3:1 and length 100 to 150 feet
- Width of hill or slope, minimum of 150 feet because of speed and space required for turning movements.

Expert Classes. The following criteria are recommended for the selection of facilities for expert classes:

- Either the same hill as advanced classes or, preferably, a longer and steeper hill
- Enough downhill length to permit a minimum of three turning movements—for example, 250 feet on a 3:1 slope
- Greater width than that of slope for advanced classes.

Cross Country Skiing

The cross-country skiing revival came in the mid-60's and its popularity has increased dramatically. The rebirth of cross-country skiing, which has become known as ski touring, has attracted many people who cannot afford to keep up with "alpine" or "downhill" skiing price tags, or standing in long lines at the lifts.

Ski touring deserves a place in physical education and recreation programs. One of the attractive features of ski touring is that a successful program can be developed with limited facilities. Unlike downhill skiing, it is not vital to have hilly terrain or several inches of snow base. Such areas as athletic fields, golf courses, parks, and nearby vacant land serve as an ideal training course.

Coasting, Sleighing, Tobogganning

Often a community has a hill or hills suitable for coasting, which become meccas for children with sleds, toboggans, and other coasting devices after every snowfall. In the absence of a natural coasting hill, some park and public works departments have built such a facility. These hills are usually located in a park safely guarded from the hazard[illegible] street traffic.

In developing local sledding (coasting) areas, care should be taken to incorporate adequate safety features. Plenty of room should be provided between sled runs, and up traffic should be isolated from the down traffic. The area should be as free as possible from hazards, such as nearby trees, grills, benches, or other park paraphernalia.

Communities with an extensive response to sledding or skiing may want to counter adverse weather with the use of artificial-snow equipment or improve the activity with a ski lift.

Sleighing is a recreational activity that uses sleighs drawn by horses or oxen. It can take place on roads, trails, or paths.

Tobogganning is a thrilling sport requiring designed space. Occasionally, natural slopes are used if they are free from obstructions and have a long bottom run-off. The common practice is to choose a hillside with a reasonable steep and even grade. A chute is constructed off a wooden trough. It can be permanent or built in sections.

Snowmobiling

According to a recent survey, snowmobiling is the third fastest-growing sport in the United States behind tennis and snow skiing. Assuming snowmobiling will continue to be popular, the predictions have it that approximately 10 million people will take to the sport by 1985. As with cross-country skiing, areas such as athletic fields, golf courses, parks, and vacant land can serve as an ideal training course for snowmobilers.

Areas for Outdoor Education/ Recreation

Future historians will surely note the decades following World War II as a time when the outdoors came into prominence as a significant place for both education and recreation. The unprecedented growth of all types of outdoor activities necessitating land areas and facilities can be expected to continue apace. A growing awareness on the part of educational and recreational leaders that the present generation and those to come are far removed from the land and the rural life of their forebears has caused much interest and concern in the development of outdoor education programs. Because of school-age children and many adults know little about the outdoors, programs and facilities must be designed to educate them in, about, and for the outdoors. An ecological approach to outdoor education has both recreational and educational implications.

Outdoor education is a term that refers to learning activities in and for the outdoors. Such activities can be provided in the curriculums of schools, colleges, and universities as well as in the programs of recreational, camping, and community agencies. Outdoor education has been broadly described as follows:

Outdoor education means learning in and for the outdoors. It is a means of curriculum extension and enrichment through outdoor experiences. It is not a separate discipline with

prescribed objectives, like science and mathematics; it is simply a learning climate offering opportunities for direct laboratory experiences in identifying and resolving real-life problems, for acquiring skills with which to enjoy a lifetime of creative living, for building concepts and developing concern about man and his natural environment, and for getting us back in touch with those aspects of living where our roots were once firm and deep.

Outdoor education and outdoor recreation encompass a great variety of activities, many of which can be conducted on a single, large tract of land. With careful planning, facilities, some in or near an urban area and others in more distant places. An outdoor-education complex on one piece of land or on several plots in close proximity has many advantages in the areas of administration, leadership, equipment, and transportation. Such a site lends itself to wide community use, with responsibilities for leadership and finances shared by several agencies. Obviously, the size and physical characteristics of an outdoor-education complex will depend on the geographic location and the topography of the land.

Some of the facilities and types of site treatment for a complex that would accommodate a broad program of outdoor education and outdoor recreation, and which would constitute an outdoor laboratory or field campus, are briefly described. It is assumed that there will be many areas and facilities, public and private, that can also be used in a comprehensive program.

Considerations in Selecting and Developing Sites

Size

The type of program planned should determine the size of the site. Size alone does not necessarily mean much except that it does affect the numbers of certain species of wildlife that might live in the area. A large area does not necessarily have a diversity of physical features. It may just be level land, harboring only a few species of trees, with no particularly outstanding features. Nevertheless, such an area could be made interesting from an educational point of view, provided good leadership is available.

Many schools, recreation departments, and community agencies already have school sites, parks, and recreational areas that should be developed for outdoor programs. Schools, as well as other agencies, in some sections of the country also have forest lands that could be developed and used in a broad educational and recreational program.

Site Characteristics

The characteristics of the site are also determined by the type of program planned. If plans call for a resident camp, many more requirements must be met than if the site will be used only on a daily basis. If the land and facilities are to contribute to all aspects of the educational curriculum, or if there is to be special emphasis on science, conservation, and outdoor skills, many characteristics will need to be considered, such as the following:

- A location to give some privacy and solitude
- Year-round accessibility by road
- A minimum of natural and man-made hazards
- Interesting geologic features, such as rock outcroppings, open field, flat terrain, and a variety of soil types
- A variety of native vegetation, including woods
- Wildlife that can be maintained with good management
- A pond, stream, seashore, or large body of water
- Demonstration areas for conservation practices
- Woods for practicing outdoor skills and use of native materials
- Sanitary facilities, including good drainage and good drinking water
- Simple shelters in the event of inclement weather
- Proximity to adequate medical and hospital services.

Special Features

Many kinds of developments are found in various types of outdoor education areas. Some of these are appropriate for camps, some for outdoor laboratories or nature centers, and some for outdoor recreational and sport centers. An outdoor education and outdoor recreation complex would include many site plans and facilities not possible in more limited areas. The adaptability of the area to the proposed program, the cost of construction, maintenance problems, aesthetic considerations, and available leadership are all factors in determining what facilities might be developed in a particular land area or cluster of acreages.

Listed below are some of the special developments that might be included in appropriate sites. Some of the features listed are discussed elsewhere in this chapter and are merely mentioned here. Others, not mentioned in other places, are discussed in more detail.

- Grass, shrubs, and trees. They provide shade, prevent soil erosion, provide food and cover for wildlife, serve as windbreaks, mark the boundary of the property, act as a buffer zone to ensure privacy against an adjacent (presently or potentially) populated area, demonstrate principles of plant growth, serve as a resource for ecological studies and give practice in forest management. A school forest offers many popular activities.
- A vegetable garden or a bog garden.
- Soil-erosion demonstration areas. Such an area should be rich in vegetation, feature good conservation practices, be situated on inclined terrain, and be located next to a piece of land denuded of its vegetation and also located on an incline. Comparisons can then be made over a period of time to determine what happens to the quantity and quality of soil in both areas.
- Snake pit. A variety of reptiles found in the local area could be kept in a circular pit about 20 feet in diameter and constructed of concrete and stone. Concave walls and a water-filled moat surrounding an island will prevent the snakes from escaping
- Wildlife sanctuary. Provide mixed plantings and construct birdhouses, feeders, and bird baths to attract a variety of birds.
- Weather station. This is for the study of meteorology and should be located in an area that can be fenced off and locked.
- Council ring. This facility provides a place for campfires, for conducting orientations before field trips, and for other special programs. The council ring should be located in a wooded area to ensure a feeling of isolation. Use logs for seats.
- Nature trails. Develop, if space permits, a variety of trails, each serving a different purpose. One may be a geology trail, winding its way through an area rich in geologic features. Another trail may emphasize the study of erosion, while still another may lead to an historic spot.

- Pioneer living area. Social studies lessons are vividly illustrated in such an area. Dramatize the life of the pioneer, including such activities as making dyes from plants, cooking outdoors, constructing shelters, learning to identify edible plants, and learning other survival practices.
- Observation platform. This platform can be used for observing birds and for studying astronomy. It should be located on the highest point of the property.
- Outdoor Zoo. Animals indigenous to the local area are featured. Be certain that arrangements can be made to care properly for the animals caught.
- Miniature gardens. Each garden features a particular grouping of native plants found in the typical setting in which they normally grow.
- Plant grafting. A demonstration area that provides interesting studies in genetics.
- Animal-baiting area. Put a salt lick and some meat in a cleared area. Place loose dirt around the baited spot, spread it, press it down with the feet, and smooth it out. Animals attracted to the area will leave their footprints, which can then be observed and studied.
- Natural preserve. An area could be set aside in which no developments would be made. It would be given complete protection and would provide a spot for the observation of ecological aspects.
- Orienteering courses. The development of several courses for map and compass use would stimulate educational and recreational use of the area.
- Greenhouse. A place for the propagation of plants, some of which may be used for area improvement, is important. A greenhouse would make possible an acquaintance with plants and would be a means of providing projects for study during the off season.
- Winter-sports area. Places for skating, skiing, and coasting would be desirable in those parts of the country that have sufficient snow and cold weather to make these sports feasible.
- Natural play area. An area set aside for children, containing such elements as climbing logs, ropes for swinging across low areas, sandbanks, and hide-and-seek areas, can provide play different from that in the city.
- Turtle pit. An attractive pit with water and plantings would make it possible the study and observation of turtles and other amphibians.
- Rifle and skeet ranges. Such an area will provide opportunities for instruction in gun safety as well as for participation in rifle and skeet shooting.
- Casting and angling area. Developments for casting and angling would serve both instructional and recreational uses.
- Amphitheater. For large-group programs, an amphitheater would be important. It could be used for lectures, drama, music, and a variety of demonstrations.
- Astronomy Area. A special area for astronomy may be developed on a large open area, waterfront, dock, or even a roof. Seating facilities are desirable, and sometimes a telescope is permanently mounted to facilitate observations.
- Bird-feeding station.
- Historical markers. Sites of old farms, early settlers' homes, Indian trails and village sites, and pioneer roads are illustrations of the kinds of historical sites that might be used for student projects.
- Shelters. Adirondack or picnic shelters can serve day-camp and day-use groups during inclement weather.
- Tree stump. Locate a fairly well-preserved tree stump. make a sloping cut, smooth the top by sanding, and treat it with a clear waterproofing material, such as fiberglas resin. Much can be learned about tree growth from carefully studying a tree stump.
- Herb garden. This garden features food seasoning and medicinal plants and serves as a useful teaching aid for a home economics class.
- Photographic blind. Construct a blind near a bird-feeding station for taking pictures of wild birds.
- Evergreen-tree nursery. Trees can later be transplanted to desired areas.
- Field archery. Targets are set up in wooded areas or fields, simulating actual hunting conditions.
- Natural areas. Such areas are left relatively undisturbed, and man-made modifications should be avoided as much as possible. These places serve as excellent resources for scientific studies of natural phenomena.
- Picnic site. It is desirable to locate the picnic site on the periphery of the property.
- Seashore areas. Communities adjacent to seashores may have areas set aside for study and observation. Developments might include ramps or walks to facilitate observation. Walkways through tidelands may be developed as nature trails. One of the national parks has an underwater nature trail.

Outdoor Laboratories

The term *outdoor laboratory* is used for a piece of land (including wetlands, lakes, and seashores) set aside by a school for learning experiences directly related to land and its resources. It may be located close to an individual school, or it may serve a group of schools. It may be a part of the school grounds or a section of a park-school development. It may consist of only a few acres nearby or of several hundred acres, nearby or many miles away. It may serve individual elementar schools, high schools, or universities, or all of them jointly. Because outdoor laboratories are extremely varied in their site possibilities and their purposes, no rigid format for their development is possible.

The term *land for learning* has been applied to the school laboratory. It implies the opportunity of school groups to study, explore, and experiment with land and its resources. Outdoor study, field trips, and experiments with water, soil, plants, and animals constitute its major functions.

Developments may range from nothing more than a few trails, with the area left natural, to nature trails, class and museum buildings, horticultural plots, developed ponds, forest plantations, gardens, and small-farm operations. The creativity of the teacher or outdoor education specialist, the potential of the available site, and funds available may be the only limiting factors in the development of program facilities.

If a laboratory is heavily used, water and toilet facilities might be essential. A storage building for tools and supplies might also be desirable.

Nature Centers

The term *nature center* is used to designate a particular type of development that will facilitate learning in the outdoors and the growth of recreational interests. The establishment of nature centers is being promoted extensively by the National Audubon Society and the Science for Young Americans Association. Several hundred such centers have been developed in the United States in recent years. Children's museums may be considered a part of this develop-

ment, although some of these museums lack adjacent lands for outdoor education.

Nature centers have been developed principally by three types of financing and management: schools, private associations, and public park and recreation departments.

The Site

Some of the suggestions for the school outdoor-education laboratory are applicable here. Nature trails, ponds, bogs, gardens, forest plantings, and the like may provide the variety essential for a rich outdoor education program.

The Building

The building should be designed so as to permit expansion as the program grows and as more funds become available. In its initial stage, the building should contain a minimum space of 2,500 square feet, which is large enough to contain one class adequately. The building should be designed according to the needs set by the program. The following general facilities are recommended:

- Office for staff
- Toilet facilities. Access should be provided to the outside as well as to the interior of the building.
- Large meeting room. The wall space can be utilized for exhibits. Low cabinets along the walls should be provided for storage of educational aids. A long counter providing work and display space should be constructed on top of the cabinets.
- Classrooms. Two classrooms should be provided so that class may be broken up into smaller groups if necessary.
- Workroom. This room would be used for constructing displays and for arts and crafts.
- Science laboratory. A room should be equipped with microscopes, soil- and mineral-testing equipment, and other materials necessary for scientific studies.
- Library. The large meeting room can contain the library, which would occupy one section of the room. The library should contain reference material, field guides, magazines, and novels concerned with the outdoors.
- Storage room. Adequate space should be provided for storage of the many pieces of instructional and janitorial equipment that will accumulate over the years.

It should be emphasized again that it is not essential for one center to have most of the facilities described here. Dynamic leadership is, to a large degree, more important, and not even the ultimate in good facilities can ever satisfactorily replace the need for effective leadership.

Interpretive Centers

Although the name *interpretive centers* might well be applied to the outdoor laboratories and the nature centers mentioned earlier, it has a specific use in describing certain facilities of public parks offered as a service to the general public and, in some cases, to school groups. The National Park Service has the most extensive development of such centers, although state and metropolitan parks have, in recent years, been expanding the number of their interpretive centers. The U.S. Forest Service is beginning to develop information centers that are essentially interpretive centers.

The primary purpose of interpretive centers is to help visitors understand and appreciate the natural, historical, or archeological features of the areas in which the centers are located. Inasmuch as the problems of interpretation of each area is different, facility developments are likewise varied.

Interpretive centers frequently contain a trailside museum or interpretive-center building. This may vary in size from 10 by 20 feet to a large, multi-roomed structure. The size depends on the groups to be accommodated, the interpretive materials available, and the types of programs to be presented. A large building may contain some or all of the following:

- Display rooms with habitat cases and other exhibits
- Office space for staff members
- A laboratory for research and the preparation of display materials
- Meeting rooms for lectures, slides, or movies
- Lavatories and toilets
- A counter for the sale of books and the distribution of pamphlets
- An outdoor amphitheater or campfire area for lectures and movies
- Trails to points of interest (often self-guiding nature trails)
- Parapets or other special observation points, often including mounted telescopes and pointers indicating places of interest
- Interpretive devices at points of interest, including bulletin boards, maps, diagrams, and displays
- Parking areas.

School groups often visit interpretive centers, usually by school bus on a one-day basis. In some cases, picnic areas are provided for such groups. Work space, where children can work on projects at the center, if often a desirable feature.

School and Community Gardens, Farms, and Forests

Gardens, farms, and forests provide direct experiences with growing plants and, in some cases, with domestic animals. Schools, park and recreation agencies, and a few private agencies have been responsible for the development of facilities. Even when facilities are developed and operated by park and recreation departments or private agencies, some direct relationship with schools is often provided through an instructional program in which the school children are enrolled.

Display Gardens

Gardens of various kinds should be developed to provide for visual, cultural, and educational equipment.

A formal garden may be composed entirely of one type of plant (such as roses), of various types of assorted plant materials, or of a series of individual gardens comprised of single types of plant units. Features such as a water fountain and statuary can be incorporated into the design.

Informal gardens should have long, sweeping lawn areas to serve as a setting for plants and flower beds. Plants may include large specimen trees, flowering trees, shrubs, and vines. The flower borders can be of varied plants.

All the plants should be of interest to the average homeowner and should be useful in helping him select plants for his own yard. Attempts should be made to keep abreast of the latest introductions and to display those types of plants that are hardy to the particular region in which the garden is located. This aspect of planting for the homeowner should be stressed in both formal and informal gardens, and demonstrations of plant cultural practics should be provided.

Naturalistic and native, or wildflower, gardens are established in a wilderness location, where the plants native to the region can be assembled in one area so they are easily accessible to the citizens. Developers will probably need an

area of varied topography—lowlands, highlands, and prairies—and an area with varied soil conditions—from alkaline to acid—to accommodate the various types of plants.

Tract Gardens

In a tract garden, which is the most common type of school or community garden a piece of property ranging in size from one to ten acres is divided into small tracts for the use of individuals. A typical plot size may be 10 by 20 feet, but adults and families can use larger gardens. A garden program with 25 plots can be set up on one-fourth acre of land, although more space is desirable. Four acres of land can hold 100 gardeners with plots of varied size and community crops. This size allows space for a service building and activity area. It should be on rich, well-drained soil with water available.

Garden programs may involve instruction, environmental projects, field trips, and science activities. Community projects may include novelty crops such as a pumpkin patch, gourds, Indian corn, and a Christmas tree farm. Gardening appeals to all ages and is an excellent program for families.

Some of the necessary or desirable features of the tract garden are the following:

- Garden building—either a small building for the storage of tools and equipment or a building large enough for class meetings and indoor activities during bad weather
- Toilet facilities adequate to care for the maximum number of participants expected on the garden plot at one time
- Greenhouse for plant propagation
- Ready access to water, with spigots and hoses available for limited irrigation
- Fencing for protection of the garden
- Pathways and walkways to provide easy access to all plots
- A demonstration home yard, with grass, flowers, and shrubs
- Good landscaping..

Preferably, the tract garden should be located within walking distance of the homes of the participants.

In many cases, gardens are developed on or adjacent to school grounds.

Tract gardens for adults and families have been established in some communities. They are usually intended for people living in crowded urban centers or apartments who would not otherwise be able to garden.

In some communities, these gardens are located at some distance from homes, and transportation is left up to the individuals concerned.

Farms

Community or school farms are becoming increasingly important, especially near metropolitan centers, and offer opportunities for a rich and varied program. Farm programs include animal care and training and traditional rural activities such as hay rides, picnics, and nature activities. Model farms are heavily used by families who just want to walk through to see and pet the animals.

Simple barns and pens contain horses, cows, pigs, chickens, sheep, and other domestic animals, which children can help care for and feed. In an urban setting it is essential that the facility be attractive and well-maintained. There must be water, feed storage, and adequate exercise space for the animals. An office, restrooms, drinking fountain, indoor and outdoor activity areas, and storage space are needed for the people.

In addition to the buildings that are generally found on a diversified farm, there are meeting places and exhibits that make it possible to carry on indoor instruction. Picnic areas, farm ponds, day-camp facilities, campfire circles, and hiking trails are often developed also.

Working farms are sometimes adapted for recreational purposes. This type of facility actually produces while city residents visit to learn, observe, take part in, and enjoy farming activities. Groups may use the farm on a day basis, and overnight accommodations can be provided. In either case, a large room and open outdoor space are needed for activity and instruction.

Farm camps offer opportunities for a farm-oriented camping experience. The farm camp is a farm not worked for production but set up for resident programs in environmental education, farm activities, natural history, science, and other outdoor recreation. There may be a large farmhouse converted to a program building and farm buildings converted to cabins. Facilities needed are a kitchen, dining area, sleeping quarters, restrooms, large activity room, and ample storage space. In addition barns, animals, farm equipment to maintain the area, and other facilities will be needed depending on the program direction.

Forests

Numerous school and community forests can be found throughout the United States. Many of these were acquired from tax-delinquent land, through gifts, or through protection programs for community watersheds. Their use has followed diverse patterns. Some schools have carried on field trips, forest improvement projects, and other outdoor education activities. In general, however, schools have not made the maximum use of such areas.

Many of these forests could be developed as outdoor education laboratories. Some might be suitable sites for nature centers, day camps, or even resident camps.

School and community forests may serve valuable purposes even without extensive development. Water, trails, and toilets may be all the developments needed to provide useful educational facilities. Such areas may serve their best functions as places in which to study the ecological changes taking place over a period of years.

Outdoor Skills and Sports Area

Outdoor skills or sports areas should be included in the outdoor education-recreation complex, but it may be necessary to acquire special sites, depending on the topography of the land. These areas should provide opportunities to learn and practice skills, but they may also be used as outdoor laboratories.

The following are some of the specialized program facilities that might be included in the outdoor skills and sports area:

- Casting and angling—platforms and open, level spaces
- Outdoor shooting range
- Archery range—target field course, archery golf, and other games
- Campcraft skills area
- Overnight camping area
- Outpost camping—Adirondack shelters
- Facilities for water sports, including swimming, canoeing, boating, sailing, skin diving, and water skiing
- Area with crafts with native materials—carving, lapidary, weaving, and ceramics—with a simple structure for inclement weather and to house equipment

- Winter sports—ski slopes and tow, ski shelter, tobogganning, and ice-skating rinks.

Natural Areas

Natural areas are generally thought of as representative of the original, undisturbed plants and animals of a locale. They may encompass a variety of habitats, such as woodlands, deserts, swamps, bogs shorelines, or sand dunes.

It is almost impossible today, even in the wilderness, to find undisturbed areas. Most places categorized as natural areas are protected lands that indicate the least disturbance and that, through protection, planting, and development, approximate the original characteristics.

It is characteristic of natural areas that they are protected from nonharmonious developments and activities. Simple access trails, protective fencing, and simple interpretive developments such as entrance bulletin boards are usually acceptable. In designated natural areas, the enjoyment and study of the natural features are encouraged, and uses that detract from the natural features are discouraged.

Schools, parks, and camps are often the agencies that develop, maintain, and protect natural areas. Such areas are valuable assets in environmental education.

Other Outdoor Areas

Information pertinent to other outdoor facilities is available in Chapter 2.

Camps and Camping

Historically, the word *camping* signified simple living outdoors and engaging in activities related primarily to the outdoors. Today the term has broadened tremendously and encompasses a wide spectrum of developments for families and children. *Resident centers, day camps, group camps, family camps, and wilderness camps* are the common designations used for the various types of camps.

Camps have been developed by public agencies at all levels of government and by many voluntary youth-serving organizations. The rapidly increasing participation of children and adults in camping necessitates careful consideration of desirable areas and facilities.

Although most organized camping takes place on agency-owned or private property, public land is becoming increasingly involved. Public land is one of the major resources for school outdoor education programs, and many resident centers have been constructed on public property or by public funds. Schools use the facilities during the school year, and park and recreation agencies use them during the summer. The purposes of outdoor education, whether sponsored by park and recreation departments or by schools, are similar in many respects, and cooperative planning is not only necessary in order to get the most from the community dollar but imperative if suitable lands and sites are to be obtained. If adequate facilities are to be provided to meet the needs of both organized camping groups and schools, the facilities must be designed for year-round use.

Resident Camps

The term resident camp is used to designate an area that provides for 50 to 150 people, with facilities for cooking, sleeping, and program development. There are three major considerations in the development of resident camps: (a) selecting the campsite, (b) planning the layout and development, and (c) constructing the buildings and facilities.

Selecting the Campsite

The selection of a site for a camp in which children and adults can live and learn is no small task. Both vision and technical knowledge are required. There is no such thing as a perfect campsite, and the plans will need to be adapted to the site available.

Camps should not be so close to campers' homes that parents can drop in at odd times. Campers feel more of a sense of adventure when camp is somewhat distant from home. About 40 or 50 miles is a desirable minimum distance. If distances are too great, however, travel costs become prohibitive. A site should offer both a sense of seclusion and reasonable accessible.

It is advisable to secure a tract large enough to provide for future growth. At least an acre per camper, in terms of predicted future use, is a minimum, If the land is especially "tender" and intensive use is planned, an even larger minimum should be considered.

Land with a varied topography and possibilities for many types of outdoor programs is highly desirable. Generally the more natural the area the better, though serious natural hazards should be avoided. Level land for buildings and certain programs is important. Drainage and factors related to use during different seasons should be borne in mind.

Water for both program and domestic purposes is essential. Water activities are important in most camps and, if not naturally available, will need to be provided artificially.

Planning the Layout and Development

Money will be saved and mistakes reduced is a camp planner, architects, and engineers are engaged to develop a master plan. Problems are considerably different from those in other types of developments, and there is no subsitute for specialized technical help. All groups who will use the camp should be considered in the plan. Planning should include consideration of the following:

- Present needs and possible future demands
- Purposes and objectives of the camp
- Possible year-round use
- Groups that will use the camp—age, sex, and socio-economic background
- Program of the camp
- Leadership
- Transportation available
- Financing of construction, maintenance, and operation
- Protection—fire, police, and off-season
- Accessibility and seclusion
- Aesthetic values.

Because a large part of the program in most camps is related to the environment, camping should take place in a natural and protected area. However, whenever large numbers of people use an area they disturb the natural resources. Camp plans should be concerned with minimizing the damage to resources through protection; careful location of buildings, roads, trails, and utilities; and planting, drainage management, and surfacing where needed.

The U.S. Soil Conservation Service will assist camps in developing land capability maps that indicate how certain land may best be used. The Service often has aerial photographs that can help in planning. Topographical maps can be obtained from the U.S. Geographical Survey. Additional surveys may be required to give greater detail. Five-foot interval maps are usually required for construction purposes.

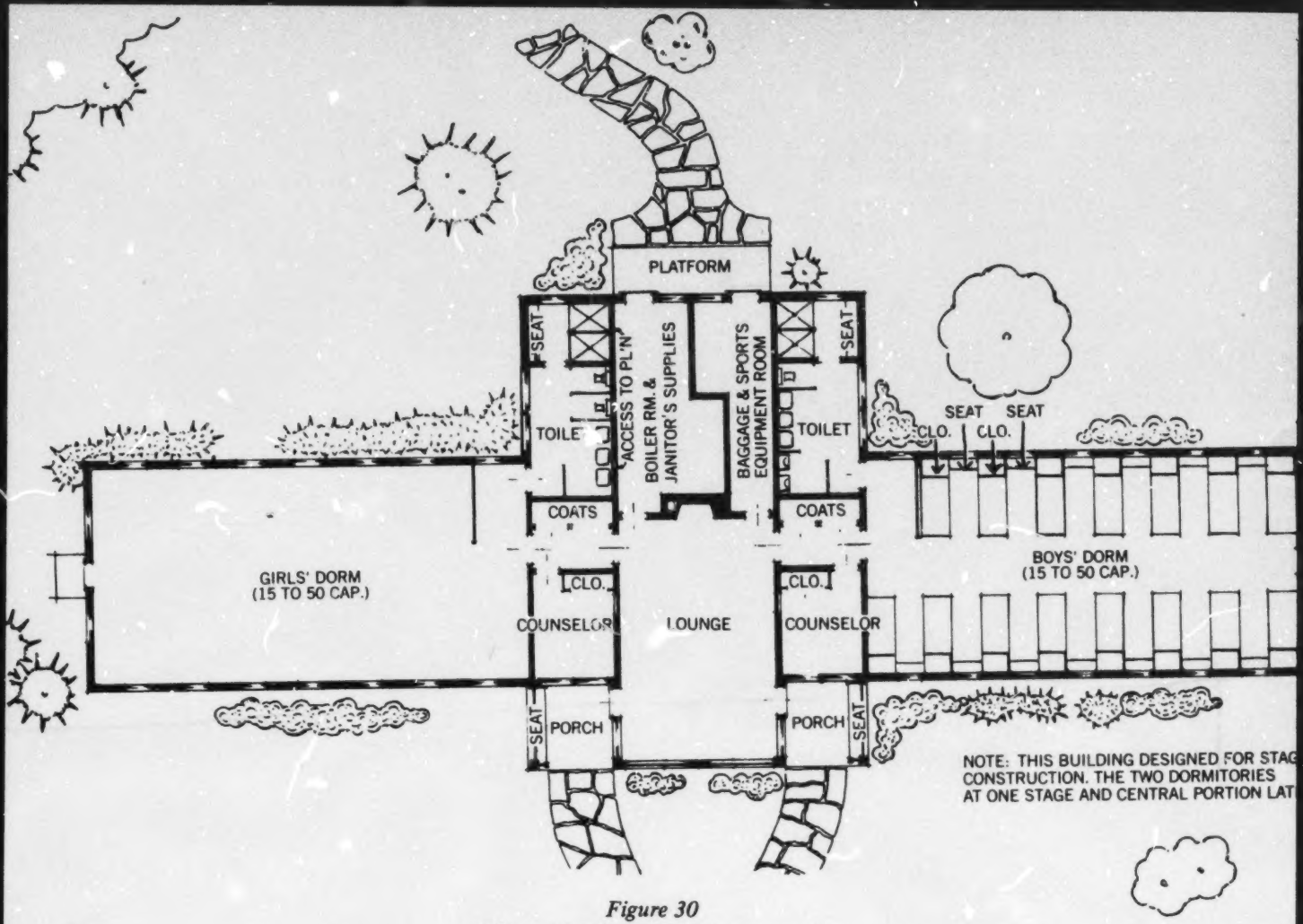


Figure 30
Floor plan of large overnight camp unit

To protect camp resources, the help of capable persons in surveying the plants, wildlife, and waters of the site should be secured.

A general layout should be planned, indicating the location of roads, utilities, buildings, and program facilities. Even though all of the plans cannot be realized immediately, they should be included.

Most resident camps today are decentralized, with either units for 18 to 30 campers or small camps for 10 to 12. If there is winter and school use, more centralized facilities for larger groups may be advisable.

The lay of the land with its natural divisions will often determine construction sites, and plans should be flexible to take advantage of the land. The following, however, are considered desirable distances between structures:

- Cabins—at least 100 feet apart
- Units or small camps—500 feet apart, or so located that there is little interference from one another
- Health center—at least 200 feet from other facilities
- Wash houses or toilets—within 150 feet of living facilities.

The main access road should be 18 to 24 feet wide and should enter the camp as far as the parking lot. The camp should have a parking lot sufficient for the number of vehicles that would normally be accommodated, taking into account that at times there may be need to park several school buses. A relatively flat, open, and well-drained area nearby can serve as an overflow parking area.

Normally, it will be expected that passenger cars will not penetrate the campsite proper. A spur drive from the main entrance road should be constructed to the kitchen and other basic facilities.

A trail system should folow natural travel routes to camp facilities. Well-planned and developed trails will protect the natural environment.

The first building approached when one enters camp should be the administration building, and the next should be the dining hall. These buildings are main points of interest, for it is around and in these facilities that many camp activities will be centered. The buildings should be placed within easy access to both the parking area and the living units.

Constructing the Buildings and Facililties

Since camp structures represent a large investment, they require the best of planning energies and abilities. Not only do these structures provide for the basic need of shelter, but they also create an atmosphere about the camp that can be a definite aid to the camp program.

The designer's objective should be to develop an exterior appearance that is suited to the region, the site, and the camp

program. Contrary to popular belief, nearly all of the standard building materials can be used to produce an attractive building. The problem of annual maintenance, as well as appearance, must be considered. Native materials should be used wherever feasible and practical. In every way, the architectural treatment of the exterior and interior of buildings and other structures should be in harmony with the motif of real camping and with the natural environment.

The structures should be planned to meet all presently known and anticipated needs. It is helpful to study plans of existing facilities and to interview present camp directors. Visits to facilities that have been in use a number of years are most beneficial, However, one should never assume that a camp plan applicable to one site should be duplicated exactly on a different site or for a different camping use. Each camp designer will have to adapt such plans to the needs of the local program.

Administration Building

The administration building will house all the administrative functions of the camp. There should be office space for the camp director and assistants, a conference room, a secretarial room, a workroom for mimeographing and mailing, and toilet facilities for men and women. Provision should be made for processing the entering and departing campers.

Telephones should be located in both the office and the health center. A public telephone is not usually recommended, and calls by children should be made under staff supervision.

Dining Hall, Kitchen, and Store

A central dining room should contain at least 12 to 15 square feet of dining space per person. It should be attractive, comfortable, and heated if used in cold weather. It should be located within five minutes' walk of camp living quarters.

The dining room should be designed so that the campers may be served at their respective tables. The lighting should be adequate, well-distributed, and without glare. Ease in cleaning is also essential. Light-colored asphalt, rubber, vinyl asbestos, or terrazzo tile make an acceptable floor covering.

Coat racks, toilets and a fireplace may be included in the plans. Easy access from the dining room to the kitchen food-service counter is important.

A person experienced in kitchen arrangement and equipment should be consulted in planning the kitchen. It should be at least one-third the size of the dining hall and should have facilities for food preparation, cooking, refrigeration, dishwashing, and storage. Greaseproof asphalt tile is a suitable floor covering.

Adjacent facilities should include a loading platform, a garbage crib, the dietitian's or head cook's office or desk space, a camp store for supplying food to cookout groups, the camp post office, and the bank. Toilet and lavatory facilities should be provided for the kitchen staff.

Housing Units

There are several approaches to the design of housing units, depending upon the needs of the groups and the program. Some camp administrators prefer to house an activity group together in one large unit, while others prefer smaller, decentralized units.

Most new camps have decentralized layouts. Camps for handicapped people and camps used the year around have special requirements related to size and winterization of living facilities.

In the large housing-unit arrangement, both boys and girls or men and women may be housed in the same building, with sleeping rooms separated by a common living room (See Figure 1). It is desirable to locate each staff room adjacent to the lounge and sleeping room so that adequate supervision can be maintained. In a school camp, this arrangement makes possible a good teacher-camper or counselor-camper living relationship.

In a resident camp designed for the use of schools, each housing unit should accommodate 25 to 30 campers. Single beds are recommended. It is also desirable to have kitchenettes in case the central dining hall is not used. Kitchenettes are especially convenient if the camp is to be used for small adult-education groups, conferences, or workshops. Flush toilets and showers should be adjacent to the sleeping rooms. Not only is this style of building suitable for adult groups, but it is highly recommended for winter camping for young children.

At least 40 square feet of room per camper should be provided in sleeping quarters, and cots should be placed at least three feet apart and so arranged that campers' heads are at least six feet apart.

Architectural design, insulation, and the heating plant will vary with the climatic conditions of the area. Comfortable beds, springs, and mattresses with water-repellent mattress covers should be provided. There should also be storage cabinets for clothes, suitcases, and personal items. Mirrors should be provided in the sleeping room and washrooms. Each sleeping room should have one writing table and chair per eight children, if these are not provided in the living room or lounge. The general lighting should be subdued, but there might be student lamps for the writing tables.

Some groups prefer to have smaller housing units more widely dispersed. This plan lends itself better to unit construction, which makes it possible to build some camp facilities immediately and add more units from year to year. It does, however, require more night-time staff. In addition to the well-placed and well-spaced housing units, there should be a central main building containing the food preparation and dining facilities.

Small housing units should be equipped with the minimum utilities. Each housing unit or cabin will accommodate approximately eight to ten campers and staff. In certain sections of the country, it is desirable to provide toilet and shower facilities in each housing unit, especially in a year-round school camp in a cold climate. In other parts of the country, unit-type toilet and shower buildings could be provided to serve more than one housing unit. The number to be served would depend upon the unit site and location.

Buildings or canvas shelters should be designed so as to seem to belong in the camp environment. Tents, tepees, covered wagons, and other movable living quarters are common in decentralized camps, but cabins are needed in severe climates.

There are two schools of thought on counselor-camper living. One maintains that counselors should live adjacent to but not in the same room with campers, whereas the other prefers that counselors live with campers. If counselors live with campers, some type of partitioning is advisable. In large winterized quarters, separate rooms for counselors may be provided next to campers' sleeping rooms.

Additional housing is usually needed for program specialists who are not charged with the daily supervision of camper

groups. A staffhouse with sleeping rooms and a lounge for the use of counselors when off duty is often provided.

The director, program staff, and caretaker, if living at camp the year round, require homes with reasonable comfort. Family homes should be located near the property entrance to assure supervision.

Health Center

The resident camp needs a center to provide health care and to house the camp nurse. Desirable features include the following:

- Space for ill campers—one bed for 20 campers, with separate rooms for male and female patients
- Isolation room for observation and temporary care of campers with suspected communicable diseases
- Treatment room
- Office space for records and nurse's work
- Housing for camp nurse
- Bath and toilet facilities
- Water heater
- Hot plate for simple food preparation.

Shower Houses

A camp without showers in the living quarters may have a central shower house or several shower houses. These should provide lavatories and flush toilets as well, and laundry facilities are desirable. The following are minimum needs:

- One shower head for 10 to 15 persons
- One toilet seat for 8 to 10 girls
- One toilet seat for 12 to 15 boys
- One urinal for 30 boys
- One lavatory for 10 persons
- Heated water for showers.

General Maintenance Building

A building of sufficient size to store the necessary equipment for maintaining the camp is desirable. It should include space for trucks, a tractor, ground maintenance machinery and tools, repair materials, and a room for miscellaneous repair work. The design of the building will depend upon the type of equipment to be stored and the nature of maintenance work to be performed by the resident maintenance staff.

Fire-fighting equipment should be kept readily available. Some campsites need fire-control systems with hydrants and hoses.

Tools, power equipment, gasoline and other flammable material should be kept under lock and key and used only by authorized personnel.

Sewer, Water, and Utilities

Resident camps need to develop their sewage systems carefully. The state board of health should be consulted during the planning so that state health requirements and anti-pollution regulations are met. Several systems may be acceptable, such as absorption fields, aeration systems with lagoons, or dry wells. State health boards generally prefer flush toilets to pit latrines, although the latter, if properly constructed, may be acceptable in decentralized living quarters.

Provision must be made for disposing of solid wastes. Community waste disposal areas, if available, are preferred. Sanitary landfills are generally considered desirable.

Adequacy and purity are the chief features to be sought in the domestic water supply. The help of the state board of health should be enlisted to assure development of an approved system. The amount needed depends on the type of camp, but a minimum of 100 gallons per person-day is usually suggested in these days of increased water usage. An adequate reserve supply should be maintained for fire and other emergency use.

The possibility of securing water from community sources should be explored. Drilled wells are generally preferred to dug wells or springs. Surface water needs to be filtered and chlorinated. Data on available water supplies may be secured from state hydrogeologists, local well-drillers, or nearby residents. Adequate and approved drinking fountains should be installed at strategic places of need.

If camps are used only seasonally, provision must be made for winter protection or drainage of water.

Electricity is usually needed in the kitchen, dining hall, office, and health center. Opinions differ on the desirability of electricity in living quarters; but if camps have winter use, electricity is generally included in living quarters.

Natural gas is usually preferred for kitchen cooking and heating.

Program Facilities

Following are some of the facilities used for various camp programs. Specifications and construction details for most are found elsewhere in this book (see Index).

Water developments. Water-related activities are among the most popular in summer camps. During the fall and spring, school groups and other groups may use developments for fishing, canoeing, and boating.

Lakes, ponds, streams, bays and inlets offer many recreational opportunities. All should be studied in detail with regard to currents, eddies, depth, slope, shoreline, debris, and other factors.

Canoeing, boating, and sailing are activities that may be conducted on a lake, pond, river, reservoir, bay, or other body of water. The water area should have accessory facilities such as floats, docks, markers, or buoys. Various sizes of water bodies are required for different activities and events. For instance, canoe-racing courses are 100, 200, 440, and 880 yards as well as one mile. Sailing requires a wider body of water because the boats usually finish to windward. The different classes of sailboats, such as Sunfish and Sailfish, require different courses.

Casting is simulated rod-and-reel fishing. Practice casting on a playing field or in a gymnasium is possible the year round. If a pond or lake is nearby, a beach or dock affords an excellent facility for the casting program.

In order to teach all phases of the activity, an area 300 by 100 feet is desirable. A football, soccer, hockey, or lacrosse field is ideal for class instruction.

Casting targets, which are 30 inches in diameter, are easily constructed and can be an excellent project for any woodshop program. It is recommended that at least 10 targets be made. Others can be added as the program expands. Targets for use on the water are also 30 inches in diameter and are made of hollow metal tubing. They float and can be easily anchored.

Campfire circles and council rings. Most camps develop centers for meetings and evening programs.

Craft centers. These may range from canvas-covered areas with provisions for storing tools to extensive and well-equipped craft shops.

Recreational buildings. Space for indoor activities, especially during bad weather, is sometimes provided by an additional story on the dining hall. Separate recreational buildings may be constructed.

Shelter houses. Wooden or canvas shelters for program purposes may be located in individual units.

Shooting ranges. Archery and target ranges are found in many camps.

Open sports areas. These range from open grassy areas for informal play to well-equipped sports fields.

Horseback riding stables. Horseback riding is an expensive but very attractive addition to camp programs.

Environmental education centers. Varied facilities ranging from open meeting centers to completely equipped indoor laboratories serve as work centers in natural science.

Day Camps

A day camp is an area and facility intended to provide a program similar to that of the resident camp except that campers sleep at home.

Planning Considerations

Many of the considerations of planning mentioned in the section on resident camps apply to day camps. However, facility problems are simpler because day campers sleep at home and usually eat two of the day's meals at home. Provisions, however simple, must nonetheless be made for water, toilets, rainy-day shelters, eating and cooking, refrigeration, first-aid and health, and program.

Abundant land for programs is extremely desirable, particularly when the emphasis is on outdoor-related activities. Reasonable isolation and a varied topography with outdoor program possibilities are essential. Natural parks, park-school areas, and community forests often lend themselves to use as day-camp sites. Some communities have developed special day-camp areas; others make appropriate picnic areas available for this special use.

Buses are often used to transport campers to the day camp. If more than half an hour is consumed in daily travel each way, the effectiveness of the program is reduced.

Units and Facilities

Day-camp groups are divided into units or counselor groups ranging from 8 to 20 campers. Most day camps provide simple facilities for each unit, including a fireplace for cooking, storage cabinets, and tables. Some day camps serve a daily meal in a central dining hall, reducing or eliminating the need for unit cooking facilities.

Storage is needed for equipment, food, and program supplies. Some day camps use trailers or trucks for storage, hauling them back and forth each day.

A well-equipped first-aid station and a rest-area facility are necessary.

Group Camps

Many public agencies today provide special campsites for small groups, such as scouts, church groups, and school classes. These sites generally accommodate from 10 to 40 persons. In most cases, the groups stay from one to five days. Small units in decentralized resident camps sometimes have facilities that can be used for group camping.

Simple fireplaces for cooking, picnic shelters for use in bad weather, toilets, and safe drinking water are necessities.

The great increase in winter camping by small groups often necessitates special developments. Some winter campers live completely outdoors in the cold, even in snow. Usually, however, winterized buildings are used for cooking, sleeping, and evening activities.

Family Camps

At one time "family camping" meant the activity of families pitching tents in natural areas, living and cooking simply, and finding their own interests outdoors. Today the term may include sleeping in tents or living in expensive motor homes, stopping overnight or vacationing in completely equipped resorts with varieties of entertainment.

Overnight or transient camps are usually strategically located for travelers passing by or for those wishing to visit nearby points of interest. These camps need to offer very little, chiefly cleanliness and comfort for short stays. They generally do not provide natural areas and recreational facilities.

Family resident camps offer complete meal and living accommodations for families or adults. The facilities may be similar to those of resident camps except that some of the sleeping quarters may be adapted to families.

Most of the campgrounds in state or federal areas are destination camps. Campers generally stay more than one night and often for several weeks.

In recent years a great many resort camps have sprung up. These resorts, generally privately developed, are more or less complete vacationlands in themselves, offering, frequently under leadership, a recreational program and facilities including swimming pools, recreational buildings, children's playgrounds, special game courts, marinas, horseback riding trails, and the like.

Sport Camps

In recent years another type of camp has developed with great interest; the sport camp. These camps emphasis a particular sport such as baseball, tennis, basketball, football, and skiing with many camps specializing in a particular facet of the aforementioned sports. The trend to sport camps has been spreading throughout the United States with great acceptance.

Planning Considerations

Development plans will depend on whether the campgrounds are intended to offer natural outdoor living experiences or just living space for overnighters or those who will spend their daylight hours visiting surrounding areas. The demand or market should be studied before plans are drawn.

Location is an extremely important factor in success. One-nighters do not wish to detour far from their main line of travel. Destination campgrounds should be near interesting areas or themselves offer attractions so that campers will stay.

The reasons for camping are extremely varied and sometimes appear contradictory. Studies indicate, however, that campers in destination campgrounds rate water activities, such as swimming, boating, and fishing, high on their lists. Socializing is important for some campers. Campfire programs and social activities attract many, but others seek solitude and outdoor experiences. Children's playgrounds or play space are important to many families.

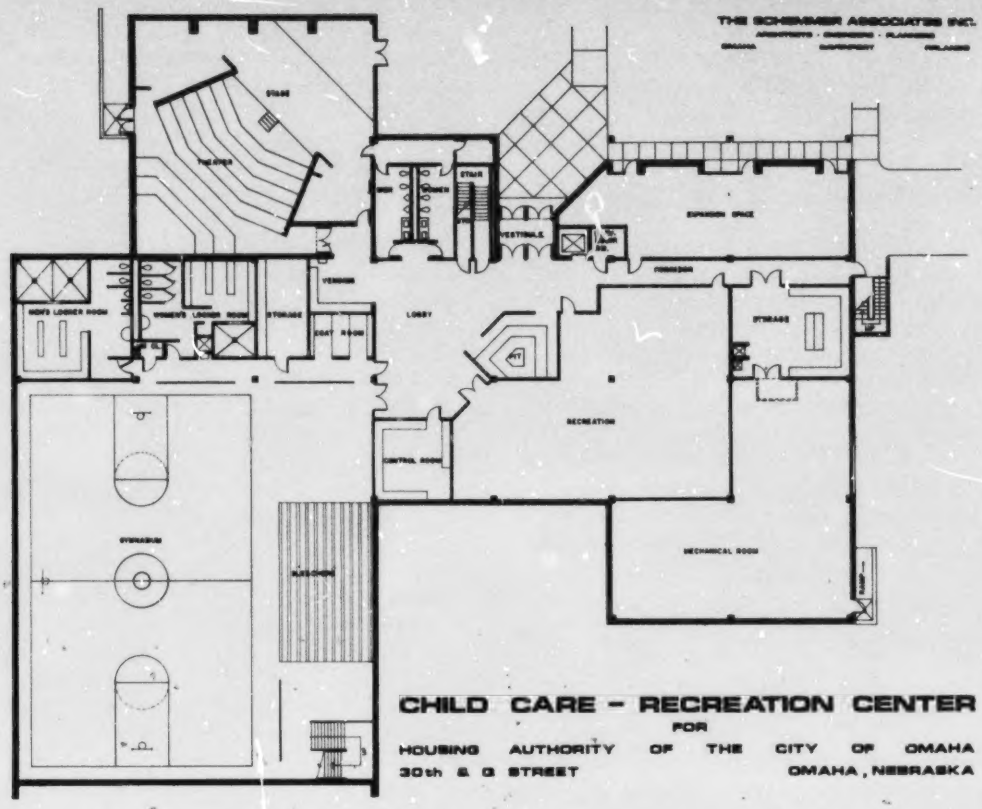


Figure 31

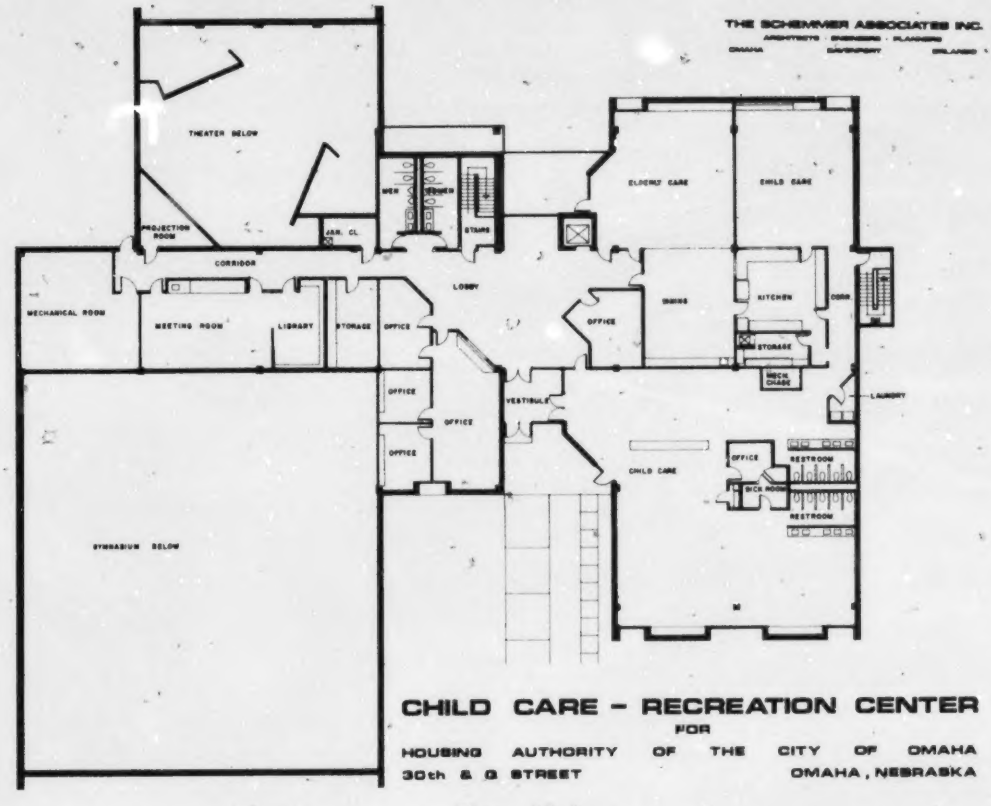


Figure 31-A

Features and Facilities

Water Supply

An ample and safe water supply is essential. Water systems must meet state health requirements and be adequate for users.

Unless water is supplied to each individual site, a water pump or faucet should be available in a central location for each 10 to 15 sites. If camps are operated in cold weather, these should be resistant to freezing.

Many camps have some complete hookups and some partial hookups. A water hookup to a recreational vehicle necessites a sewage hookup as well. Fill and waste valves are generally prohibited. With hookups, standard hose connections for sewer pipes are provided for connection to the left side of each recreational vehicle.

With increased demand for clean toilet facilities, wash houses have come to be considered necessary. They should be located within 300 to 500 feet of camp sites. Facilities should be provided as follows:

	Men	Women
Flush toilets	1 for 30 sites	1 for 15 sites
Urinals	1 for 30 sites	
Lavatories	1 for 15 sites	1 for 15 sites
Showers	1 for 30 sites	1 for 30 sites

Dumping stations are desirable where recreation vehicles are accommodated without complete hookups. Sink water and dishwater disposal can be problems, and drain pits should be provided. Camps anticipating lengthy stays should provide laundries, either in wash houses or separate buildings.

Garbage and Refuse Disposal

Provision for refuse disposal is an important aspect of campground development. Insect problems, odors, smoke, unsightliness, and the public health are at stake.

Refuse should be placed in durable, water-tight, nonabsorbent, and easily cleaned containers. Heavy-duty galvanized 20- or 30-gallon containers with plastic lining bags are widely used. Garbage from individual campsites should be wrapped in newspaper before being placed in containers. The containers should be placed no farther than 100 feet from camp sites. There should be a container for each two to four campsites. The containers should be placed on bases or hung from brackets above ground level.

Administrative Facilities

The office should contain general office space, first-aid equipment, telephone (preferably a pay phone for campers), and information center. Sometimes the office may be part of the operator's home. The operator must maintain a register of campground occupants and include information required by state agencies.

Centrally located bulletin boards should give information regarding campground rules, how to report a fire or reach police and doctors, church services, parks, golf courses, laundries, auto repair shops, shopping areas, special events, and other items of interest in the locale. Maps of the campground and surrounding area are desirable.

Many camps operate small stores with limited supplies of groceries and equipment.

Individual Campsites

Six to eight sites per acre are common in natural areas, with 50 to 75 feet between tent or vehicle locations. Minimum size for a site is about 2,500 square feet. In transient or even resort camps, recreational vehicles may be allotted as little as 30 by 40 feet each.

Tent campers require space for tents, outdoor cooking, and camp living. Grills or combinations of grills and fire circles for evening campfires might be provided.

There is a tendency to provide electricity even if no other hookups are provided in sites in natural areas. In transient camps and often in resort camps, complete hookups with sewer connections, water, and electricity are usually available.

Outdoor tables with benches are needed by tent campers but not as much by users of recreational vehicles.

Access for recreational vehicles to individual sites requires careful planning. Most campgrounds provide back-in spaces, which make it possible for four vehicles to obtain water and electrical connections from one post, thereby reducing utility costs. A rather wide road is needed when back-up spaces are provided, so that large trailers may be maneuvered into place.

Surfacing

Natural woodland surfaces and grass are desirable in natural areas. Since these surfaces are subject to erosion with overuse, areas should be rested from time to time if adequate space is available. Grass is the surface preferred by most campers but is often difficult to establish and maintain.

Gravel or hard surfacing is generally essential for drive-ins and back-ins. Gravel is also provided in areas adjacent to recreational vehicles. Cement pads may serve as walks and patios for individual sites.

Program Facilities

Because campgrounds differ so markedly, program possibilities also differ. Overnight campgrounds may find a lounge, a children's playground, and a small pool more than adequate. In many natural areas, the surroundings themselves may be the greatest attraction, and few developments may be needed. A few of the many possibilities for program developments are suggested here:

Water Activities

Water is one of the most important recreational attractions, particularly for destination campgrounds, as it provides for swimming, boating, fishing, and scenic beauty.

Swimming and boating facilities are discussed elsewhere in this publication. Marinas may range from simple boat docks or beaches to full-fledged marinas for large boats. Specifications for marinas are discussed in Part Four, Chapter 3.

A fish-cleaning center is needed if fishing is an important sport. A cleaning table with running water and a drain into sewage facilities should be available, either open or enclosed in a fly-tight building. Containers for discarded parts are essential. The areas must be kept clean or they become aesthetically and hygienically offensive.

Boat rentals, motor repair, and sales of bait, motor fuel, and fishing equipment are important sources of revenue in many camps. These features require suitable buildings, equipment, and personnel.

Picnic Grounds

Picnicking use varies from a single-family picnic to a large-group picnic involving several thousand people. Accommo-

dations range within these two extremes and require careful planning to ensure proper control and maintenance.

In large parks providing picnic groves and fireplaces accommodating an appreciable number of people, a large open shelter with a fireplace in one end is highly desirable to give protection from sudden rainstorms. Shelters are built in varying sizes from 20 by 30 feet, accommodating approximately 60 persons seated at picnic tables, to 30 by 50 feet, which will accommodate about 150 people. It has also been found desirable in some areas to provide electrical service for night-picnic use.

The areas of heavy use, such as near the picnic shelter, toilets, and drinking fountains, should be hard-surfaced. These sections, then, should have tables for large groups and be located near the parking area. The area for smaller gatherings and play equipment should be located beyond the facilities for large picnic groups. The groupings of picnic facilities, such as tables, easily accessible trash receptacles, and fire grates, should be designed to take advantage of the topographical features, trees, fine views, and other similar factors that make an outing a pleasurable experience.

Tables of various kinds of material are available. In congested or metropolitan areas where picnic grounds are subject to continuous vandalism and destruction, and where there is not much supervision, picnic tables that will withstand abuses from the general public should be provided. Normally, this will require a table in a fixed location and with a hard-surface area under it.

In the more native or natural areas away from heavy populations, such as county or state parks, heavy rustic types of wooden picnic tables and facilities may be more desirable because of their appearance and the fact that they blend with the natural surroundings. Usually, these types of areas are not as heavily used, are not so susceptible to vandalism, and have more space available for the distribution of picnic uses so that the surfaces of these areas do not become worn out, as is frequently true of city parks.

Other features that may be incorporated in picnic areas are a council ring, barbecue pit, and picnic shelter. There seems to be a general trend toward people bringing their own cooking utensils, and it has also been the experience over past years that a small picnic grate for charcoal use is highly satisfactory and more economical to construct. A large fireplace made of stone or other similar material is subject to vandalism and deterioration.

Other Facilities

Recreational buildings may be simple, open-sided shelters or fully developed buildings containing many of the features of community buildings as previously described. In overnight camps the buildings may provide shelter for eating and bad-weather activities. In resort camps they may house full programs including square dancing, bingo, cards, slide shows, lectures, group singing, and so on. An indoor lounge for informal get-togethers, reading, and watching television is often provided.

Large grassy open space offer opportunities for informal play. Campgrounds of all types frequently contain equipped playgrounds for children.

Hiking trails, horseback trails, and self-guiding nature trails are popular facilities. Commercial campgrounds sometimes provide facilities for miniature golf, volleyball, badminton, shuffleboard, horseshoes, and other sports.

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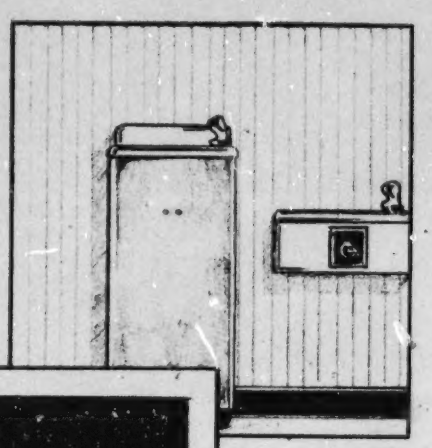
(See annotated bibliography in the appendix for related articles.)

VIII. Planning for the Handicapped



Planning for the Handicapped

IN RECENT YEARS much interest in problems of *architectural accessibility* has been expressed by personnel from many different disciplines and walks of life. Despite federal legislation, state mandates, and local regulations, facilities have been built and renovated without consideration for individuals with handicapping conditions. Many students with physical impairments and orthopedic conditions are still relegated to special schools simply because they cannot function in existing buildings!

Similar problems are related to athletics, physical education, recreation, aquatic, and camping programs and facilities. Individuals with influence in these areas have publicly stated that laws, mandates, and regulations requiring accessibility were not intended for recreation facilities. However, these situations are changing.

While specific barriers are being eliminated and facilities made accessible, not enough is being done in attacking the major cause of these situations—*attitudinal barriers.* Although major emphasis currently is on eradicating symptoms —architectural barriers themselves—basic attitudinal problems must be kept foremost in mind. Only with concerted effort and attention to *both cause and effect* can problems of accessibility be eliminated entirely.

Removal of these barriers in facilities used for athletics, physical education and recreation so *everyone* can use them regardless of handicapping conditions must be accomplished. Yet, attitudinal barriers between leaders and participants, planners and users, therapists and patients must also be eliminated. To convey a positive attitude toward problems of access for all, the term *accessibility* rather than architectural barriers is recommended.

The importance of actively involving the handicapped persons themselves in all aspects of planning, and evaluating facilities cannot be overemphasized. Unique needs of individuals with different handicapping conditions can provide valuable input which generally may not be available from others involved in planning processes. This same consumer involvement needs to be incorporated in planning processes for *programs* which are to exist in given facilities.

Accessibility and Attitudes

Architectural barriers deny many members of society convenient access to indoor and outdoor facilities. Individuals with different handicapping conditions are often hindered in getting from one place to another by such barriers. Limitations placed on mobility thus may isolate participants, prevent individuals from getting needed services, and even leave some in dangerous situations. Bathrooms too narrow for people in wheelchairs to use and flights of steps which prevent them from changing floors are examples of such barriers. Curb cuts placed in best positions for wheelchair users can create orientation problems for independent, mobile blind persons. Architectural accessibility is complex and requires a great deal of thought and cooperation among those involved.

Architectural barriers not only affect individuals with permanent or obvious physical conditions, but persons with temporary or hidden conditions as well. Individuals with baby strollers, persons who must temporarily use crutches, those wearing leg braces, or individuals with heart conditions are just a few affected by architectural barriers in accessibility and whose needs are often overlooked. Only 17% of physically impaired persons are born with such conditions. The other 83% acquire disabilities through disease, accident, war, or old age. Most people, at one time or another, are personally affected by architectural barriers. Even if an individual is not so affected, the need for all facilities to be accessible to *everyone* is imperative as basic human and civil rights.

All features of barrier-free design must be linked as part of a coordinated whole. An accessible restroom on the second floor of a building cannot be used if the only way to the second floor is up a flight of stairs. Ramps must be planned and placed to complement such features as steps and archi-

tectural style. Curb cuts on one side of the street are of little value. Each barrier must be eliminated according to specific criteria to be *functional* as well as to meet certain standards.

Despite federal, state, and local legislation requiring that all facilities be accessible, many communities and states continue to isolate special populations in segregated facilities or in special classes in regular schools. Able-bodied persons still impose their wishes on special populations whether these approaches and procedures are appropriate or desired by those for whom such services are designed. Special projects, task force groups, advisory panels, planning committees, and countless other groups explore problems of facilities and equipment for special groups. Unfortunately, few of these planning groups ever invite input from those most directly involved—the impaired, disabled, and handicapped consumers and their families. As a result—

- Some playground designed for severely mentally retarded adults are better suited to Marine Commandos!
- Braille trails go unused by blind individuals!
- Totally accessible facilities are found to be far from totally accessible!
- Millions of dollars are used to build special facilities not needed or wanted by groups for which they were designed!

Many expensive special facilities are unnecessary. Participants want to take part in programs in facilities little different from those used by their peers and contemporaries. *Basic accessibility and availability* are key considerations. In planning any program or activity—including facilities—it is *imperative* that several groups be included in making decisions that so intimately affect them.

Consumers themselves—individuals with various handicapping conditions for whom programs, activities, and facilities are planned and implemented in ways not consistent with what people for whom they are designed want. The impaired, disabled, and handicapped persons—including mentally retarded individuals—must be consulted for this kind of input.

Providers of services who are going to use facilities, direct programs, and coordinate activities must provide input. Too often architects dictate program by facilities they design rather than solicit input from those who are going to provide these services.

By obtaining input from consumers and providers of services, facilities can be made functional for programs, activities, populations, and leaders who are going to direct and guide activities in these facilities. Some of the most practical, functional, and inexpensive recreational facilities developed for the impaired, disabled and handicapped have been planned by these people themselves.

Current emphasis is on returning or keeping persons in the community and on programs in *least restrictive environments* and *most normal or integrated setting feasible.* Thus, an ever-increasing need to make existing facilities accessible and functional for *everyone,* including the mentally retarded and those with other impediments. With state and private residential facilities also providing recreation programs and leisure opportunities for many of these same people, coordinated plans should emphasize approaches whereby handicapped persons can use community facilities. In this way, special populations can use facilities in terms of their individual needs.

Legislative Foundations

Several legislative mandates require that facilities built or renovated with federal funds be accessible to individuals with handicapping conditions. All states have similar legislation governing facilities built with state funds and most states possess matching legislation for building renovated with state funds. Increasing numbers of local jurisdictions—cities and counties—are requiring accessibility through ordinances, building codes, and similar regulations. Three key federal mandates with which *everyone* responsible for and involved in planning, implementing and evaluating building and renovation processes should be familiar are—

- *An Act to Ensure That Certain Buildings, Financed with Federal Funds Are So Designed and Constructed As to be Accessible to the Handicapped,* more commonly known as *The Architectural Barrier Act* (Public Law 90-480).
- *The Rehabilitation Act of 1973* (Public Law 93-112) containing a non-discrimination on the basis of handicap clause (Section 504) which states, "No otherwise qualified handicapped individual shall, solely by reason of his handicap be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving federal financial assistance." Participants with handicapping conditions must also be provided program opportunities in most normal settings appropriate to the maximum degree possible.
- *The Education for All Handicapped Children Act* (Public Law 94-142) requiring free appropriate education for all handicapped children. Physical Education is specified as part of the definition of special education and as such must be provided in least restrictive environments with nonhandicapped classmates to the maximum degree possible.

Each state has adopted corresponding laws regarding federal legislation, particularly P.L. 90-480, P.L. 93-112, and P.L. 94-142. Such state legislative information needs to be part of planning processes since state requirements must meet federal requirements and in some instances are more stringent than federal laws.

Design Guidelines

At the present timme a variety of resources deal with adapting facilities to make them free of architectural barriers. *The American National Standards Institute (ANSI) Standards for Making Buildings and Facilities Accessible to and Usable by Individuals with Handicapping Conditions* were issued in 1961 and reaffirmed in 1971. A project at Syracuse University School of Architecture to adapt and extend these standards was completed in 1977.*

**As of date this publication was printed, specific details on availability of new ANSI standards had not been released.)*

Although standards for architectural accessibility may vary to some extent according to specific conditions and unique factors at state and local levels, most jurisdictions use directly or modify slightly basic ANSI Standards. However, experience has shown that in some instances facilities meet standards but are not really functional or usable. For example, a small porch or stoop that is only three feet wide meets the standard but is functional only if the door opens

inward. At least five feet are necessary if the door opens outward. These inconsistencies emphasize the need for input from the consumers themselves.

Although most standards pertain to basic accessibility of buildings and related structures, such barrier-free design features apply also to physical education and recreation area facilities. In fact, basic accessibility and availability are far more important factors to consider in these areas than specialized facilities per se. Basic factors to consider for accessibility of all facilities are—

- Avoiding making *old* facilities accessible through addition of new facilities without carefully analyzing how *old* facilities can be made usable to persons with handicapping conditions.
- Avoiding designs which provide accessibility for part of a facility and create extreme internal barrier problems in other parts of the facility.
- Minimum height factors for mirrors, telephones, lavatories, faucets, elevator bottoms, and switch controls should consider their locations as well as populations being served.
- Ramp gradients and turns need to consider all forms of wheelchairs—self-propelled, electric.
- Sufficiently large restrooms with grab bars and accessible sinks and mirrors.
- Low public telephones.
- Low and easily-operated water fountains.
- Non-skid floors.
- Elevators, ramps, and/or special lifting devices rather than steps.
- Proper lighting.
- Doors at least thirty-two inches wide.
- Ramps with a slope not greater than one foot rise in twelve feet.
- Hand rails that are smooth, extend one foot beyond the top and bottom, and are placed on at least one side of ramps that are 32 inches high.
- Door thresholds flush with the floor.
- Curb-cuts.
- Special and extra large parking spaces for vans and with sufficient space between cars when doors are open.
- Braille markers on elevators and in other key places for information.
- Sound system for emergencies and other program uses.
- Visual warning system for emergencies.
- Pedestrian-operated traffic signals with standardized time-delay to allow deaf or blind persons enough time to cross streets safely.
- Meeting rooms designed so deaf persons can clearly see interpreters, visual display areas, and others in the meeting.
- See-through panels in doors, unless privacy is necessary, to allow deaf persons chances to see into rooms before entering.
- Anti-static carpets to avoid interference with hearing aids.
- Flashing light attachments on phones to indicate rings.
- Fire alarm and smoke detection systems attached to strobe lights to ensure that deaf persons are notified of dangers.
- Other emergency messages conveyed graphically —i.e., a sign in an elevator could flash *help is on the way* should the cab become stuck.

Modifications and Adaptations

Modification of any existing building is predicted on the principle that needs of impaired, disabled and handicapped people are exactly the same as needs of able-bodied individuals. Where facilities are available to physically able persons, they should be designed to be accessible to and usable by physically impaired persons. Conversely, all facilities should be planned, designed, and constructed so that they are accessible to *everyone*, including the most severely, profoundly, and multiple impaired persons.

Many factors must be considered when establishing priorities for modifying facilities. However, it is difficult to recommend a set of priorities which apply to all building types. It is necessary to consider individuals with different handicapping conditions. So often the only considerations are given to individuals with mobility difficulties while ignoring needs of those with sensory impairments.

Most necessary facility adaptations are included in *American National Standards Institute Standards*—pitch of ramps, size of restrooms and adaptations of stalls, heights of drinking fountains and telephones, size and placement of parking spaces, type and pitch of walks, size of door jambs, placement of hardware—and only need to be applied to athletic, physical education, and recreation facilities. Common sense application can be made to certain aspects of these facilities—

- Extend pitch of ramps for nature trails, walks, and other areas requiring locomotion.
- Make nature trails, walks, swimming pool decks, and similar passage areas a minimum width for two wheelchairs to pass.
- Lower basketball goals and reduce apparatus size for elementary school age youngsters because of their sizes, chronological ages, and functional levels, not because they are in wheelchairs.
- Use lights behind basketball backboards that are synchronized with the game clock and timer's horn to assist those with hearing problems.

This kind of planning input and recommendations from participants is very important. Many of the most practical, functional, and realistic adaptations have been suggested by consumers themselves.

Although early legislation focused on accessibility requirements for new construction, emphasis is now shifting toward making existing buildings barrier-free. Some state and municipal building codes, such as those of Massachusetts and Chicago, stipulate, with certain exceptions, that any remodeling of public buildings must result in accessibility for *everyone*. North Carolina has made a two million dollar fund available for remodeling state facilities to make them accessible. Federal tax credits can be obtained by companies as incentives to remove architectural barriers.

Financial Considerations

An often-used rationalization for not making existing facilities barrier-free and accessible has been cost. Some preliminary estimates for acceptable renovation projects have been as high as forty to one hundred percent of projected costs. Removal of barriers has actually been accomplished in many of these same projects for as little as three or four percent above costs of the renovations without the special

considerations. When plans to make building barrier-free and accessible are included from the beginning,increase in costs have been found to be in the range of one-tenth of one percent to one percent above total project costs without these factors being considered. Other comparisons include one cent additional per square foot to make a building accessible and thirteen cents per square foot to keep floors in this same building clean!

Another argument dismissing the cost myth is evidence that such buildings have fewer hazards that result in accidents and liability claims. With safer conditions, rate reductions may be obtained on liability insurance.

The concept of creating a barrier-free environment is more readily accepted than the cost of making facilities accessible. Lack of research into cost-benefits as well as actual costs of barrier-free construction are two factors that allow fear of exorbitant costs to continue.

If is difficult to make a direct comparison between original construction costs and costs for renovating a building years later. Modifications to existing buildings usually cost more than new construction because often something must be removed or changed drastically before making changes to insure that the facility is barrier-free and accessible.

Despite possibilities of increased costs, existing facilities must be made accessible as soon as possible. Cost of removing barriers must be included in established maintenance budgets as well as those used for capital improvements. While more costly than making new facilities barrier-free and accessible, renovations and modifications of existing facilities are not nearly as expensive as generally felt. In fact, actual figures and percentages for this process are many times lower than figures often given.

Benefits of barrier-free design are realized by able-bodied persons as well as by those with mobility or sensory problems. A recent study by the American Mutual Insurance Alliance noted the following advantages of accessible facilities:

- Few accidents in public buildings reduce losses and rates under health insurance policies.
- Wide doors and ramps permit rapid evacuation since standards recommended for aiding persons with handicapping conditions also meet highest fire prevention standards.
- Since buildings with aids for individuals with handicapping conditions have fewer hazards that result in accident and liability claims, insurance rate reductions may be obtained on public liability policies when architectural barriers are removed.
- Elimination of barriers also reduces chances of work-connected accidents so that employers benefit through reduction in compensation insurance premiums.

The *Community Development Block Grant Program* makes funds available to eligible cities and countries when their needs are documented. Local officials are responsible for assessing community needs, planning appropriate development of projects and activities, and taking the initiative to develop proposals to obtain these funds. An analysis of housing needs of residents with handicapping conditions along with appropriate proposals to meet these needs must be included in plans if a municipality is to receive funds under this Block Grant Program. Some ways Community Development Block Grants can be used to help individuals with handicapping conditions include:

- Acquiring, constructing, or revamping special areas for full use by persons with handicapping conditions.
- Fostering cultural activities through neighborhood libraries or museums, and promoting activities such as crafts and homemaking.
- Using funds for special projects to remove material and architectural barriers to promote mobility and accessibility in urban areas.
- Planning, managing, and evaluating community activities designed for persons with handicapping conditions.
- Planning for the design, location, and operation of community mental health centers, group homes, and recreation centers for individuals with various handicapping conditions.

Guidelines for Community Action

Communities must make sure that appropriate barrier-free provisions are incorporated into locally applicable building codes while at the same time ensuring compliance with federal and state laws already on the books. The following are considerations for initiating community action:

- Insure best possible results with respect to removing and eliminating architectural barriers by imposing on architects, engineers, and contractors even more rigorous requirements than those found in current building codes and popular standards.
- Form an architectural barriers task force to inform decision-makers about problems of architectural accessibility, focusing on both practical and social aspects of accessibility.
- Develop a standing committee on architectural barriers to encourage local interest in eliminating barriers, serve as basis for continuing community education, organize and oversee such projects, be an advocate for rights of those with special needs, approve all architectural designs for new and reconstructed facilities, and be involved in all dimensions of the decision-making process relative to facility design as it affects accessibility and usability for individuals with special needs.
- Reach newspapers, television, radio, newsletters and local periodicals with this important message.
- Develop a guidelines position paper to use in recruiting influential individuals to join this effort. This document could be developed by the standing committee previously mentioned or a general advisory committee and should include essential features as a —

— general philosophical position on accessibility and usability by those participating in the facility as well as by those employed or visiting the facility;

— clarification of the meanings of terms such as impaired, disabled, handicapped, special populations, individuals with special needs;

— statement on provisions for appropriate access and traffic elements, restrooms and equipment, building equipment and furnishings, environmental controls, gradients and textures, communication and orientation methods; and

— statement as to legal materials and other resources which are to be used to insure that the architectural design truly meets the needs of special populations.

- Provide all architects engaged in designing the facility with copies of the guideline position paper and legal resources identified in the document.
- Conduct a survey to determine accessibility of community buildings.
- Prepare a guide on accessibility of community facilities.
- Set up a watchdog program for continuous contact and follow-up with building owners, architects, and builders to ensure that new and renovated buildings are accessible to and usable by all individuals.
- Include representative numbers of impaired, disabled, and handicapped persons in all aspects of planning, implementing, and evaluating all such projects and activities, especially at decision-making levels.
- Develop an information resource center containing essential information relative to barrier-free design and construction and related laws and legislation. Essential information identified in the guideline position paper could be communicated to architects, engineers, and contractors retained to design the facility and to those or persons responsible for finally approving any facility design as it affects persons with handicapping conditions.

Architectural Barrier Survey

Parking

a. Is an offstreet parking area available adjacent to the building?
b. Is the parking lot surface hard and smooth?
c. Are there parking spaces wide enough to allow a car door to be opened to full extension (approx. 12' wide)?
d. Are there specifically identified parking spaces for the handicapped?
e. Are there curbs, wheel stops, or parking barriers within the parking area?
f. Has a curb cut, ramp, or passageway been provided to eliminate these barriers?

Building Access

a. Are walkways at least five feet wide with smooth hard surfaces (no sand or gravel), free of deep cracks, ruts or sudden changes in level?
b. Is the most accessible entrance to the building one which avoids unsafe traffic crossings from the parking area to the building entrance?
c. Is the approach to the entrance door on ground level?
d. Are there steps in the approach to or at the entrance door, if so, how many are there?
e. If there are steps, is there a sturdy handrail in the center or either side of the stairs?
f. If there are steps, has a ramp been provided to eliminate the barrier?
g. Are the ramps constructed in such a way that the grade does not exceed a 1:12 ratio, that is for every foot in length it gains no more than 1" in height?

Building Entrance

a. Is the doorway at least 30" wide?
b. Are thresholds and door saddles flush with floor or no higher than ½"?
c. Is the door automatic?
d. Are there steps or interior level changes?
e. If there are steps or interior level changes, have ramps been provided to eliminate these barriers?
f. If there are steps, is there a sturdy handrail in the center or either side of the stairs?

Elevator or Lift

a. Is the building multi-story?
b. Is there a passenger elevator or lift?
c. Does the elevator or lift provide access to all essential areas?
d. Are there any steps, or interior level changes between essential areas which are not served by an elevator?
e. Have ramps been provided to eliminate these barriers?

Rest Rooms

a. Would one need to go up or down steps to reach the rest room?
b. If, yes, have ramps been provided to make these areas accessible?
c. If there are steps, does each flight of stairs have a sturdy handrail in the center or on either side?
d. Is the width of the toilet room entrance doorway at least 30" wide?
e. Are thresholds and door saddles flush or no higher than ½" to the floor?
f. Is there enough space within the rest room to allow a wheelchair to turn around (approx. a 5' diameter)?
g. Is the width of the toilet stall door opening at least 30"?
h. Are toilet stalls and urinals equipped with grab bars?
i. Does the stall door open outward?
j. Has the door been replaced with a privacy curtain to eliminate doors?
k. Are sinks and mirrors low enough for use by children or a person in a wheelchair (bottom of mirrors no higher than 40")?

Telephone

a. Is the public phone mounted low enough to be used by children and persons in wheelchairs (the coin slot or receiver arm 50" or less from floor)?
b. If located in phone booth, is the opening into the booth at least 30" wide?
c. Would one have to go up or down steps to use the telephone?
d. If yes, have ramps been provided to make the telephone area accessible?

Wall Mounted Controls

a. Are all vital wall controls (light switches, door knobs, elevator controls, etc.) located within reach of child or person in wheelchair approximately 48" from the floor?
b. Are all emergency equipment (fire alarms, instruction panels, fire entinguishers, etc.) located within the reach of handicapped individuals and children (approx. 48" or less from floor)?

Water Fountains

a. Are water fountains low enough to be used by children and persons in wheelchairs (bubblers approx. 33" from floor)?
b. Are there any barriers, such as steps, around or leading to the water fountain?
c. If so, have ramps been provided to eliminate these barriers?

Visually Impaired

a. Have braille markers or relief graphics been used to communicate important information to the visually impaired?
b. Has textured paint or a change in surface texture been used to alert the visually impaired to curb cuts, sudden level changes, or other vital information important to the independent use of the area by the visually impaired?
c. Have any other adaptions for the visually impaired been provided, if so, please indicate. _____

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Survey developed by Linda Nierenberg, Director of Planning and Design, Human Resources Center, Albertson, Long Island, New York

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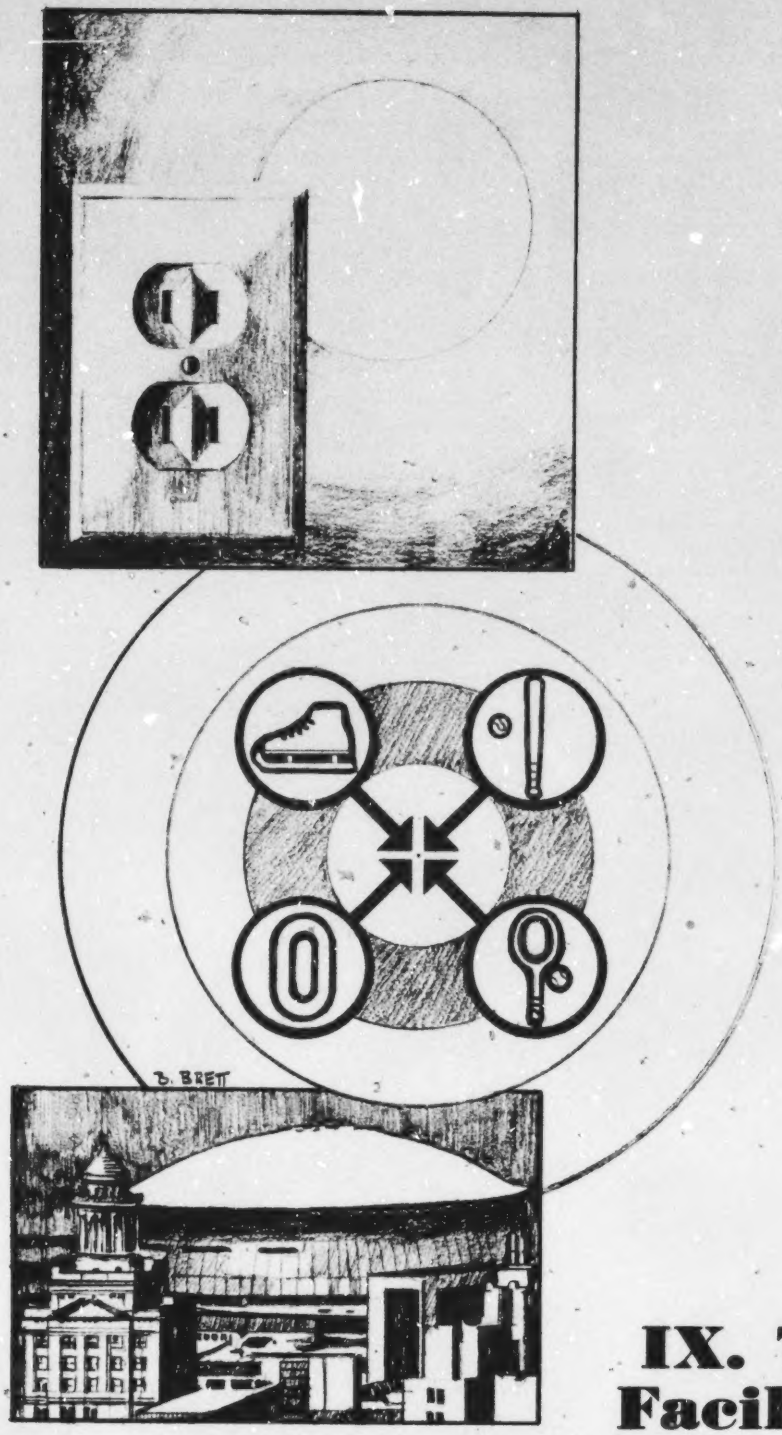
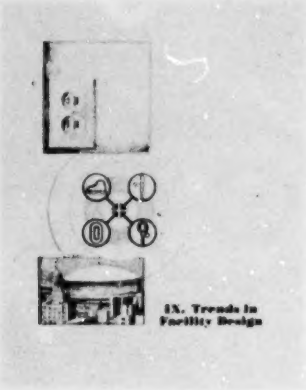


IX. Trends in Facility Design



Trends in Facility Design

THE TYPE AND extent of facilities that will be provided for athletics, physical education, and recreation in the future will be determined by a variety of factors. Heading the list are economic conditions at the time of construction, technological advances in construction methods, materials and equipment, legal requirements (both as to building construction and to program requirements), program changes and emphasis, new games, fitness activities and sports innovations, and student interest and enrollments. The challenge to facility planners is to predict accurately program trends and emphasis for the next 20-25 years, in order to provide flexibility and expandibility to accommodate changing curriculums and activities.

Basic Trends

Probably the trend having the most immediate impact on facility planning is the decreasing student enrollment in the past decade which resulted in a reduction of new school construction, particularly at the elementary level. As the elementary school age group grows older, high school and college building construction may also be reduced. This enrollment factor, along with the reluctance of the public to support additional school costs through real estate taxation will force school and college administrators to assess plant needs and building plans carefully so as to provide suitable facilities at reasonable costs. Economic factors may call for joint occupancy by school systems and recreation departments, by colleges and community groups and, in many instances, by public and private enterprise, in order to share financing and reduce costs in construction, maintenance, and operation of facilities for each agency.

Although school enrollments are down, with a resultant downward trend in overall school construction, the public demand for physical recreation and for facilities in which to participate in sport and fitness activities has increased. The trend in life style is to physical fitness. More people in the United States, of all ages, are participating regularly in some form of physical exercise than ever. Growth is most apparant in jogging, tennis, racquetball, cross country skiing, softball, tema handball, platform tennis, grass skiing, and skateboarding, to name a few.

Participation in sports and physical activity is no longer a youth phenomenon. Fitness programs for the aging are being recommended by medical authorities and demanded by senior citizens. Business and corporate employers, concerned for their employees' health, are promoting fitness programs and providing facilities for these activities. The expansion potential of these fitness programs is immense and must affect future commercial building planning and senior citizen centers.

Participants are demanding facilities and, where these are not provided by the public sector, private sports clubs and private industry have constructed facilities for participants willing to pay a fee. The number of racquet clubs, as single or multi-purpose (tennis, squash, racquetball, and swimming) clubs is increasing. Membership in private multi-purpose clubs usually ranges from very young to old with activity for the entire family, including babysitting facilities. The demand is not only for additional court space and swimming, physical fitness aspirants and the sports innovators are asking for parcours or jogging exercise trails, for bicycling tracks and road-racing circuits, for skateboard parks, for climbing walls, and for softball parks. The demand at present outweighs the ability of public agencies to provide these spaces and a new industry in sports and health facilities is growing.

Rental fees for the use of a facility are increasingly used to help defray the cost of construction, operation, and maintenance. Some public agencies operate facilities on a lease-back arrangement. A private party constructs the facility and the public agency operates it on a lease arrangement over a period of years. Or, the facility is constructed with public funds and operated by a private company. Rental of school or college facilities to non-school or off-campus groups, e.g., a college hockey rink being rented to a youth hockey league, enables the school to recover some of the costs of construction and operation, gives fuller utilization of the facility, and

usually gains community support because of the reduction in overall school costs. Some municipalities charge fees for use of facilities to cover costs of operation.

Private clubs and private industry charge membership fees as well as use fees on an hourly basis to cover operation, maintenance, and construction costs and, in private industry, for profit. Judging from the growth in the number of private clubs and the substantial membership fees, individuals are willing to pay if they can be assured of a place to participate in the sport of their choice. The present building boom in private club and commercial sports facilities demonstrates this ability and willingness to pay. Planners of institutional sports facilities may need to alter building plans to accommodate rental groups. Additional space, service facilities; traffic patterns, and security provisions may be necessary.

In many high schools and colleges the number of students involved in intramurals, sports clubs, varsity, and general recreational activities overcrowds existing facilities. The demand by women for equal use of facilities and equal programs, and by the handicapped to be involved in recreational programs, is challenging program directors to provide sufficient and suitable facilities for each program. Men and women students are asking that additional activities be included in the program, such as rugby, soccer, lacrosse, team handball. Accommodation of these programs requires that facilities be available from early morning to late evening and that outdoor facilities be usable in the evening and during inclement weather. An illustration of the demand for play space is the ice hockey community where some of the rinks are open almost continuously for 24 hours to accommodate all the groups that want ice time.

Legal Requirements and New Legislation

Trends in facility construction and remodeling will be influenced by the legal requirements of several federal laws passed in recent years in addition to those safety codes and construction regulations already applicable. The Occupational Safety and Health Act (OSHA), 1970, requires safety in construction, maintenance and equipment installation. An example of the type of regulatory concern in this act relates to noise level. Workers shall not be exposed to as many as 90 decibels for more than an 8-hour day. Many state and municipalities have similar safety and health ordinances as well as environmental pollution legislation that requires all construction to meet the safety and health requirements of their codes. Facility planners must review the requirement of statutes to meet standards for a particular facility. Modification in plans and construction may be needed to meet the requirements.

Title IX of the Educational Amendment Act of 1972 is designed to end sex discrimination in American education. The act requires that all educational institutions receiving federal funds take measures to equalize their policies, programs, and facilities. Each institution must provide equal intercollegiate, club, recreational, instructional, and intramural athletic opportunities to members of both sexes. Among other criteria, equal opportunity in athletics is assessed by determining whether appropriate equipment and supplies are provided; games and practice times are fairly scheduled; locker rooms, pratice and competitive facilities are equitable and medical and training facilities are equally provided. The use of a gymnasium, pool and gymnastics area, for example, exclusively by one sex is prohibited. Separate restrooms, change and locker rooms, showers, baths, and toilet facilities, permitted by Title IX on the basis of sex, must be comparable in convenience and quality.

Title IX does not require that sex-segregated administrative units be merged. Sex-integrated offices within newly combined units are recommended to speed actual integration of previously separate units. Segregated offices for male and female staff can be justified, particularly where toilet or shower facilities are attached, but there should be no discrimination in the size of the office and provision of equipment.

Physical education classes must be sex-integrated. Intramurals and athletics as an integral part of the educational program are fully subject to Title IX regulations. To meet Title IX requirements, changes have come about in the curriculum and physical education programs. The requirements of Title IX are legal and moral responsibilities of education and greatly influence the planning, remodeling, and/or building new school or college facilities for athletics, physical education, and recreation.

The Women's Educational Equity Act of 1974 (WEEA) was enacted as Section 408 of the Educational Amendment Act of 1974 (Public Law 93-380). Present educational programs are frequently inequitable as such programs relate to women and frequently limit full participation of all individuals. The purpose of the law is to provide educational equity for women. Among the provisions of this act are an expansion and improvement of educational programs and activities for women in vocational education, career education, physical education and educational administration. This act also has implications for administrators in the planning, remodeling, or construction of new physical education facilities.

The regulations of the Education for All Handicapped Children Act, Public Law 94-142 and Section 504 of the Rehabilitation Act of 1973 which became effective October 1, 1977, are designed to assure that all handicapped children have available to them a free appropriate public education and that they are educated to the maximum degree possible with their non-handicapped peers in least restrictive environments. Physical education is the only curricular area included in the definition of special education, whereas recreation is specified as one of the related services that can be provided handicapped children.

Specifically, activities included in the list of areas for participation are non-academic and extra-curricular services such as athletics, transportation, health services, recreational activities, special interest groups and clubs. Physical education services, specially designed if necessary, must be made available to every handicapped child receiving free appropriate public education. Each handicapped child must be afforded the opportunity to participate in the regular physical education program available to non-handicapped children. Regulations also require that the school make provisions for supplementing services such as resource room or itinerant instruction to be provided in conjunction with regular class placement.

The provisions of this Education for All Handicapped Children Act require specially designed locker, shower, dressing and toilet facilities, as well as ramps to physical education areas to provide opportunities for the handicapped to participate in all programs. Doors and thresholds must accommodate wheel chairs and students on crutches. Provisions for the hard of hearing and blind are required. Remodeling of older structures to provide for the handicapped is essential in public school and college physical education and recreation buildings. Designs of future buildings must accommodate these programs. (Details for providing for the handicapped are expanded in Chapter 8.)

The "Amateur Sports Act of 1978" provides a one-time

supplemental appropriation for amateur sports in the United States, the federal government's involvement in the amateur sport movement will have long term effects on both athletic programs and facilities. The establishment in recent years of national training centers will influence the direction of future athletic, physical education and recreation facilities. Other countries throughout the world are well ahead of the United States in providing national facilities for amateur sport.

Curricular Trends

Another major factor which needs serious consideration in school and college facility planning is the rapid expansion of the physical education curriculum to include classes in recreation-oriented activities such as hiking, camping, canoeing, sailing, rock climbing, survival activities, surfing, fishing, skiing, cross country skiing, self-defense activities, ice hockey, ice skating, and bicycling. These activities along with the traditional individual, dual and team sports, aquatics, and dance-rhythmic activity must be accommodated in a new facility. New buildings should be designed for the student's increased awareness and need for physical fitness, increased participation in individual sports, and increased emphasis on the "new games." Other trends in college are increased participation in intramural sports, shared facilities and integrated programs, and increased emphasis on women's competitive and recreational sports and dance. New facilities should be designed differently than our traditional gymnasium and field house. The facilities should support the new curriculum rather than hinder its development. Buildings must also be planned for new methods of teaching and the greater use of audiovisual teaching aids.

Economic, Aesthetic and Environmental Factors

While it is now possible to design almost any type of structure, there are economic and environmental factors that will influence the facilities built. The emphasis on environmental protection requires planners to consider all aspects of construction and design and their impact on the environment—the site, the building design, the traffic engendered because of the new building, and changes the facility will bring to the surrounding area. An impact study is usually required prior to construction and may result in changes in the final plans. The energy crisis affects building design and operation. Natural gas, oil, and hydro-electric power to supply heat and electricity for the building will be in short supply in the future. Buildings cannot be constructed using only traditional power sources and equipment and expect to function economically.

Computers are a fact of life in modern building maintenance and may be used to reduce operational costs. Computers can control building temperatures, water supplies, water temperature, lighting, ventilation, and swimming pool circulation and filtration systems. Computer controls can be extended to building security and other aspects of operation to save work hours and reduce energy costs.

In the last decade, there has been a growing emphasis on innovative ideas which enhance the design, flexibility, and function of the building. There is a need for less expensive techniques of providing the needed space. Costs of conventional structures have become prohibitive. Lack of new construction in the past ten years has forced many schools to "make do." For these school districts the challenge is to update existing facilities and provide more usability of the available space.

Reassigning space from one activity to another, by having large areas that can be subdivided and/or changed as needed, can prove quite functional. The concept of providing portable indoor recreational facilities might not be too far-fetched. Consider a mobile structure fitted with locker, shower, and changing facilities and attached by a breezeway to an air-supported structure. This self-contained locker and showering facility, with the air structure, could be moved from one part of the community to another and from one community to another as the need arises.

The aesthetic quality, outside and inside, of a sport, physical education, and recreation facility must be considered throughout the planning stages. The vast size of such structures requires that they blend with the surroundings.

Aesthetic appeal can be achieved inside the facility through the selection of appropriate colors for floors, walls and ceilings. The use of color, murals, and design art can enhance the aesthetics of indoor areas and should be incorporated where appropriate.

Technological Advances and Equipment

The changes now possible in facility design due to improved technology seem astounding. Whether or not they become realities can only be speculative. Other changes are presently being incorporated into new buildings. Some of the innovative concepts which may affect future facility design in physical education-athletic complexes are rotating permanent seating, pool surfing, climbing walls, electric carpeting, paper structures, air roofs and walls, increased use of synthetics and membranes, new lighting and acoustical treatments, and electronic security and energy management systems.

Surfing is a popular sport which could only be offered at schools in close proximity to an ocean. Now, through use of mechanization, surfing pools can be built. Electrical carpeting installation in classrooms, audio-visual centers and laboratories make conventional sockets and extension cords unnecessary. The total floor is an electric circuit. Beneath the floor covering is a grid of electricity. The equipment cord can be pushed into any spot on the floor to obtain electricity.

More and more demand for usable space, may bring about the use of elevated people platforms in high ceiling gymnasiums. The platforms are likely to be controlled by air pressure or hydraulics and consist of whole teaching stations such as a gymnastic area or weight area. The platforms will be suspended at varying heights and be completely movable when high ceilings are necessary. Wasted space may not be a problem. The new problem may be how to employ all available space.

New security systems are being employed in high risk areas to protect equipment and facilities. The use of internal electronic security systems can detect any attempt to enter a protected area and relay the break-in to a central control panel in the school's security area. The exact area of entry is visible on a central control board within a second after entry. Entire buildings, schools and universities can be totally equipped with such an electronic internal security system. Electronics also may be employed in energy control. Electronic computer systems limit peak electric demands, control temperature, program motors, lock doors and operate lights. The system can control doors in case of fire to seal off the fire area. Other electronic usage can be found in scoreboards, lasars, and daily computerized schedule boards in locker rooms.

Many other new products are adaptable for physical

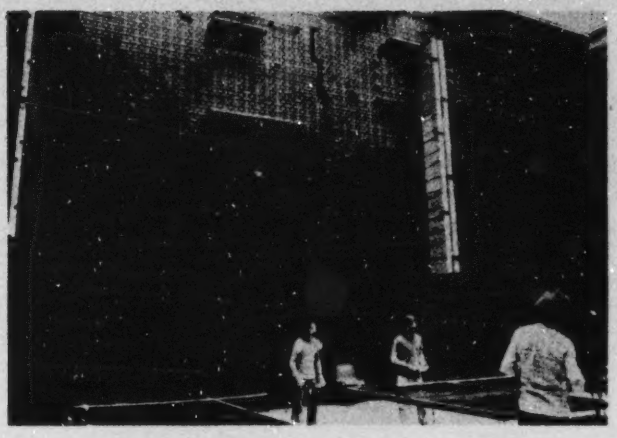
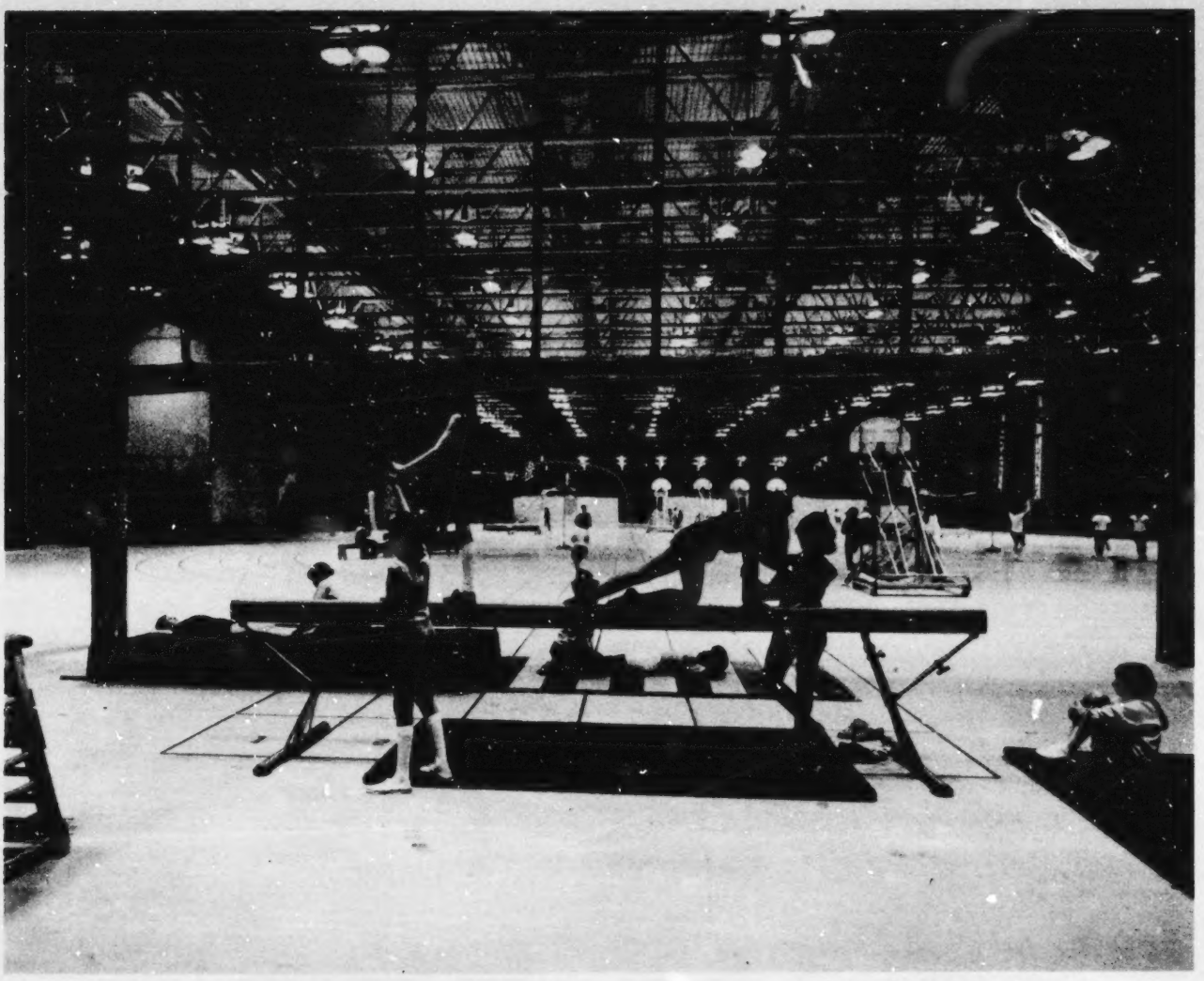


Figure 1
Small games room with a climbing wall

Figure 2
Synthetic grass ski ramp for [illegible]

Figure 3
Thomas Jefferson Junior High and Community Center in Alexandria, Virginia, provides flexible space for changing programs. (Photo by J. Alexander, Chevy Chase, Md.)



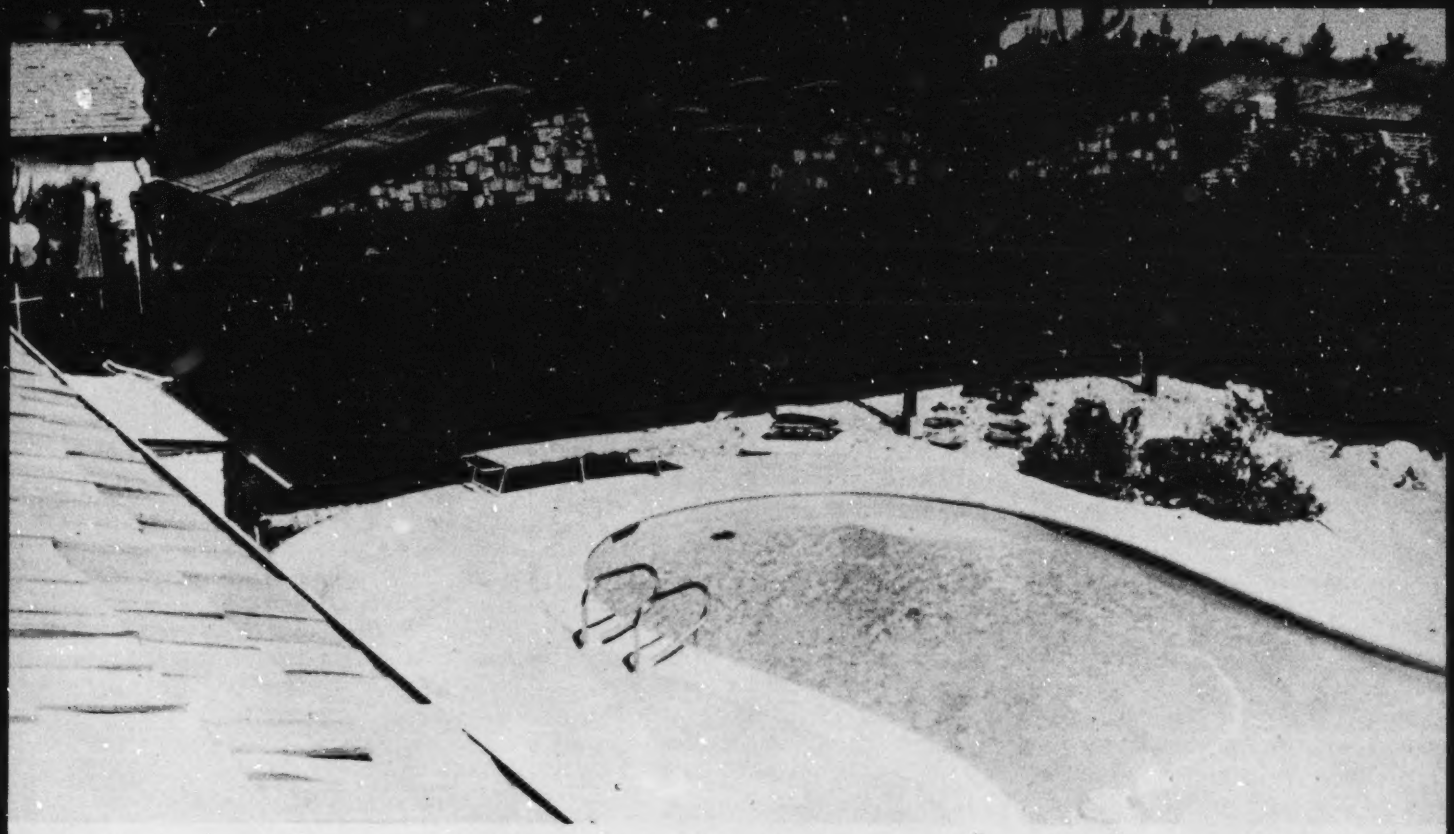


Figure 4
Solar heating has prolonged the swimming season

Figure 5
East Orange (N.J.) Middle School makes effective use of roof

oto courtesy of UNIPLAN

education-athletic facilities and designers of future complexes should investigate these. A few words of caution are necessary in that many times it is difficult to convince architects and state planner to try out new concepts. This is a major challenge above and beyond the challenge of facility design itself. Specialists should keep abreast of new trends and have resource materials available to convince planners of the validity of these innovative facility ideas. It must be understood, however, that any new facility concept which is adopted may encounter problems that cannot be foreseen until the concept takes its physical form. The solution is usually found and the concept perfected for future planners.

Ideas for Planning Facilities

Following are some ideas for renovating existing buildings or for planning new construction that takes into account current trends in education and technology:

- School districts and municipalities forced to close elementary schools because of falling enrollment should consider converting them to sports and recreational community centers.
- Facilities for developing outdoor recreation skills could be incorporated in urban facilities, i.e. climbing walls in the gymnasium or outer wall of the school building.
- An ice arena not used in the summer could be planned for multi-use as an exhibition hall, convention center, riding ring, or rodeo arena. When synthetic ice becomes feasible, the rink could provide year-round skating.
- Public recreation planners could consider including a restaurant, bar, and/or babysitting facilities in recreation centers. The practice is popular in Europe.
- Mini physical fitness corners in classrooms and corridors could be planned in elementary schools so activity is not confined to the gymnasium alone.
- Creative, adventure and/or junk playgrounds should be considered for children's playgrounds in addition to the traditional playground equipment.
- School districts or municipalities might consider stacking facilities—placing a complete sports facility in a few locations and minimal facilities in the remainder of the district to reduce costs while providing all facilities in the district.
- Adoption of the metric system should be incorporated in any new, remodeled, or converted facility to accommodate official game requirements.
- Carpets of the new long-wearing fabrics could be installed in all areas where the rug surface is compatible with use. The carpet is less expensive in overall cost than floor tile. Over a period of years, the difference is significant in acoustical quality, climate control, physical and psychological comfort.
- Parcours or fitness trails could be planned on almost any school or college outdoor area. The trail requires a limited path for running and a small area for each fitness station.

Trends in planning facilities for athletics, physical education and recreation are influenced by the participants and programs, by legal requirements and legislation, by technical innovations, and by social and economic factors within the district. Facility planners should carefully assess the current trends in order to provide functional facilities for future as well as current use.

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(See annotated bibliography in Appendix for related articles)

APPENDIXES

Appendix A

A BUILDING SERVICE CHECK LIST

Developed by David Griner
Dept. of Recreation & Intramurals, Ohio State University

Programmed custodial and maintenance services are extremely important to the smooth, economical, and efficient operation of a facility for athletics, physical education, and recreation. The following list is a reference point for developing your own plan. Items may be added or deleted where necessary. Each facility manager must select the frequency of services for his facility based on several factors such as size, type of activity, number of participants and spectators, surface materials, hours of operation, etc.

Based on your needs, plan the frequency rate on the blank provided.

Twice Daily	Monthly
Daily	Bi-Monthly
Three Times a Week	Quarterly
Two Times a Week	Semi-Annually
Weekly	Annually
Bi-Weekly	As Required

GYMNASIUMS, MULTI-PURPOSE AND CONDITIONING ROOMS

_____Dry mop, sweep all gymnasiums and all activity areas and their adjacent rooms, corridors, lobbies, stairways and courts.
_____Apply cedar san type sealer to all wood floors after each mopping. Remove all scuff marks.

Synthetic Gym Floors

_____Dust mop
_____Wet mop
_____Scrub
_____Strip and re-coat (2 coats)

Wood Gym Floors and Handball Courts

_____Dust mop
_____Damp mop
_____Strip and re-coat (2 coats)

Conditioning Rooms

_____Vacuum carpet
_____Dust mop tile floor
_____Damp mop tile floor
_____Strip and refinish tile floor
_____Clean bleacher areas completely, including washing seats, cleaning floors, sealing floors.
_____Mats — Damp mop and disinfect.

POOLS

_____Clean and sanitize pool deck, showers, steam room, and corridors between these areas.

Pool Decks

_____Scrub with tergiquat solution (2 oz. per gallon)
_____Pick up with wet/dry vacuum
_____Rinse with clear water
_____Pick up with wet/dry vacuum
_____Clean out drains

Pool Bottom

_____Sweep

RESTROOMS, SHOWER ROOMS, LOCKER ROOMS

_____Clean, sanitize, service and restock restrooms, using an approved germicidal cleaner to disinfect lavatories, commodes, urinals, partitions, fixtures, mirrors, towel and soap dispensers.
_____Damp mop floors using clean water and a germicidal disinfectant.
_____Damp mop restroom floors.
_____Fill drain traps with water.
_____Sanitize urinals.
_____Sanitize restroom partitions.
_____Sanitize commodes.
_____Provide tissue paper as needed.
_____Sanitize sinks.
_____Provide hand soap and paper towels.
_____Clean and buff tile floors.

OFFICES, CLASSROOMS, CONFERENCE ROOMS

_____Do general housecleaning, including cleaning under and behind furniture and dust walls.
_____Vacuum carpeted areas. Spot clean spills as soon as possible.
_____Clean.
_____Inspect upholstered furniture. Vacuum fabric on upholstered furniture.
_____Spot wash vinyl and shampoo fabric as needed.
_____Damp mop vinyl furniture
_____Clean classroom chairs and tables.
_____Damp mop all classroom/lab floors.
_____Clean and polish office desks and wood furniture.
_____A thorough and complete vertical and horizontal dusting of the following areas:
furniture, file cabinets, desks, ledges, and sills, railings, partitions, picture frames, etc.
_____Clean paneling.
_____Clean tables and chairs in conference rooms.
_____Damp mop lobby and first floor corridors per request of building coordinator.
_____Water and sponge clean all lab/classroom/conference room chalkboards and trays.
_____Vacuum and clean erasers. Restock chalk trays with chalk and erasers.
_____All chalkboards with DO NOT ERASE leave until cleaning is requested.

GENERAL

_____Empty and damp wipe all ashtrays.
_____Custodial employees shall not admit anyone into the building except properly identified recreation or department of safety personnel.
_____Check all entrances prior to leaving to see that building is secure. This includes closing and securing windows and interior doors.
_____Alert University Police by telephone of illegal entry, flood, found items, or emergency.
_____Immediately report all fires by telephone.
_____Interior doors may be unlocked only in the areas of active work performance.
_____Do not unlock all interior doors at the beginning of a shift.
_____Empty waste and sanitary receptacles. Remove soft and hard trash to assigned areas.
_____Custodial personnel will be responsible for policing the area around the dumpster.
_____Plastic liners for waste receptacles will be replaced as needed.
_____Soap and water clean all waste receptacles in the building.
_____Report any items requiring repair, i.e., lights, latches, doors, windows, etc.
_____Note safety items.
_____Wash interior glass and sills of exterior windows.
_____All lights must be turned off except in the areas of active work performance.
_____Do not turn on large areas of lights at the beginning of a shift or during a shift.
_____Turn off lights except night lights after completing services.
_____Spot wash walls, interior doors and frames.
_____Dust mop/sweep concrete floors.
_____Damp mop concrete floors.
_____Seal concrete floors.
_____Dust coat racks, radiators, window ledges, doors, furniture, and lockers.
_____Clean supply and exhaust vents and grills.
_____Damp mop floor areas in all stairwells.
_____Wash all handrails and dust risers.
_____Thoroughly clean stairways (including dust mopping steps, landings, dusting rails, risers, and removing spillage with damp mop).
_____Dust mop non-athletic wood floors. Strip and rewax.
_____Clean and sanitize water fountain. Polish stainless steel.
_____Exterminate (particularly pool filter) rooms, locker rooms.
_____Clean all light fixtures, vents, grills (both supply and exhaust), ceilings, and walls.
_____Dust mop resilient tile and terrazzo floor surfaces. Spray buff.
_____Vacuum tracks and remove prints and smudges from doors and wall areas in elevators. Dust mop and spot mop.
_____Sweep and/or dust mop all unoccupied areas.

Appendix B

METRIC CONVERSION TABLES

These tables are extracted from the Standard Edition of METRIC CONVERSION TABLES, courtesy of Arena Publications Ltd., 325 Streatham High Rd., London, SW16 3NS, England. For complete distance conversion tables in quarter-inch increments to a distance of 350 feet, please refer to the original publication.

TABLE V—DISTANCE EQUIVALENTS. IMPERIAL - METRIC.

YARDS	METRES	MILES	METRES
50	45·72	1 mile (1,760)	1,609·34
54·68	50	2,000 yards	1,828·80
55	50·29	1 mile 527·23	2,000
60	54·86	1 mile 1,520·84	3,000
65·62	60	2 miles (3,520)	3,218·69
70	64·01	2 miles 854·45	4,000
75	68·58	3 miles (5,280)	4,828·03
76·55	70	3 miles 188·07	5,000
80	73·15	3 miles 1,281·68	6,000
87·49	80	4 miles (7,040)	6,437·38
90	82·30	4 miles 615·29	7,000
98·42	90	4 miles 1,708·91	8,000
100	91·44	5 miles (8,800)	8,046·72
109·36	100	5 miles 1,042·52	9,000
110	100·58	6 miles (10,560)	9,656·06
120	109·73	6 miles 376·13	10,000
120·30	110	6 miles 1,469·75	11,000
150	137·16	7 miles (12,320)	11,265·41
164·04	150	7 miles 803·36	12,000
180	164·60	8 miles (14,080)	12,874·75
200	182·88	8 miles 136·97	13,000
218·72	200	8 miles 1,230·59	14,000
220	201·17	9 miles (15,840)	14,484·10
250	228·60	9 miles 564·20	15,000
300	274·32	9 miles 1,657·81	16,000
328·08	300	10 miles (17,600)	16,093·44
330	301·75	10 miles 991·43	17,000
350	320·04	11 miles 325·04	18,000
437·44	400	11 miles 1,418·65	19,000
440 (¼ mile)	402·34	12 miles 752·27	20,000
500	457·20	13 miles 85·88	21,000
546·81	500	13 miles 1,179·49	22,000
550	502·92	14 miles 513·11	23,000
600	548·64	14 miles 1,606·72	24,000
656·17	600	15 miles (26,400)	24,140·16
660	603·50	15 miles 940·33	25,000
765·53	700	18 miles 1,128·40	30,000
770	704·09	20 miles (35,200)	32,186·88
874·89	800	24 miles 1,504·53	40,000
880 (½ mile)	804·67	25 miles (44,000)	40,233·60
984·25	900	Marathon*	42,194·99
990	905·26	30 miles (52,800)	48,280·32
1,000	914·40	31 miles 120·66	50,000
1,093·61	1,000	35 miles (61,600)	56,327·04
1,202·97	1,100	40 miles (70,400)	64,373·76
1,312·34	1,200	45 miles (79,200)	72,420·48
1,320 (¾ mile)	1,207·01	50 miles (88,000)	80,467·20
1,421·70	1,300	62 miles 241·33	100,000
1,531·06	1,400	75 miles (132,000)	120,700·80
1,640·42	1,500	100 miles (176,000)	160,934·40

Note: Figures shown in brackets after miles in bold lettering, indicate the equivalent distance in yards; Continuation figures after miles in italics are yards, i.e. 11 miles 1,418·65 = 11 miles 1,418·65 yards.

* **Marathon: The distance in mileage = 26 miles 385 yards.**

TABLE IV—TIME CONVERSIONS FOR RUNNING EVENTS.

100yds./100 Mts.	220 yds./200 Mts.	440 yds./400 Mts.	880 yds./800 Mts.
Add 0·8 to 1·0 sec.	*Subtract 0·1 sec.*	*Subtract 0·3 to 0·4 sec*	*Subtract 0·7 to 1·0 s.*

The above additions and subtractions are those officially used by statistical organisations in converting times. As far as 120 yards and 110 metres (hurdles) records are concerned, metric times will also include a record at yards. The table below shows approximate conversions of middle distance events.

1 Mile	1,500M	2 Miles	3,000M	3 Miles	5,000M	6 Miles	10,000M
3:47	3:30	8:00	7:25	12:30	12:57	26:00	26:56
49	30·9	04	29	35	13:02	10	27:06
49·2	32	05	30	40	07	20	16
50	32·7	10	34	45	12	30	27
51·4	34	15	39	50	17	40	37
52	34·6	16	40	55	23	50	47
53·5	36	20	43	13:00	28	27:00	58
54	36·4	25	48	05	33	10	28:08
55·7	38	27	50	10	38	20	18
56	38·3	30	52	15	43	30	29
57·8	40	35	57	20	48	40	39
58	40·1	38	8:00	25	54	50	49
4:00	42	40	02	30	59	28:00	29:00
02	43·9	45	07	35	14:04	10	10
02·2	44	49	10	40	09	20	21
04	45·7	50	11	45	14	30	31
04·3	46	55	16	50	20	40	41
06	47·6	59	20	55	25	50	52
06·5	48	9:00	21	14:00	30	29:00	30:02
08	49·4	05	25	05	35	10	12
08·6	50	10	30	10	40	20	23
10	51·3	15	35	15	45	30	33
10·8	52	20	39	20	51	40	43
12	53·1	25	44	25	56	50	54
13	54	30	49	30	15:01	30:00	31:04
14	55	35	53	35	06	10	14
15·1	56	37	55	40	11	20	25
16	56·8	40	58	45	17	30	35
17·3	58	45	9:03	50	22	40	46
19·5	4:00	50	07	55	27	50	56
20	00·5	55	12	15:00	32	31:00	32:06
25	05·1	40	58	05	37	10	17
30·3	10	50	9:07	10	42	20	27
35	14·4	10:00	17	15	48	30	37
41·1	20	10	26	20	53	40	48
45	23·6	20	35	25	58	50	58
51·9	30	30	44	30	16:03	32:00	33:08
55	32·9	40	53	35	08	10	19
5:02·7	40	50	10:03	40	13	20	29
05	42·1	11:00	12	45	19	30	39
13·5	50	10	21	50	24	40	50
15	51·4	20	31	55	29	50	34:00
24·3	5:00	30	40	16:00	16:34	33:00	11

Appendix C

A GLOSSARY OF TERMS

Accessibility: The characteristic of facilities conveniently available to those whom they were designed to accommodate.

Acoustics: The science of heard sound, including its production, transmission, and effects; the qualities of a room that have to do with how clearly sounds can be heard or transmitted in it.

Adapted Activities: Recreational events adjusted to fit the needs, interests, and capabilities of the physically and/or mentally handicapped.

Aggregate: Any hard material (usually sand and rock) for mixing in graduated fragments with a cementing material to form concrete, plaster, or the like.

Aging: Those manifestations of the aging processes that significantly reduce mobility to perform either physical or mental tasks but are not accounted for in other categories.

Angle of Reflection: The angle between the reflected ray and the normal or perpendicular to the point of reflection.

Angle of Refraction: The angle between the refracted ray and the normal or perpendicular drawn to the point of refraction.

Apparatus: A collection or set of devices designed to contribute to physical development by providing opportunities for climbing, swinging, balancing, and performing gymnastic stunts.

Appraisal Survey: A method of evaluating the existing community recreation or school resources, program, and service in accordance with some established standards or criteria.

Aquatics: Sports performed in or upon the water.

Arts and Crafts: Activities that serve as outlets for creative expression and provide opportunities to find satisfaction through making things with the hands, such as carving, modeling, weaving, painting, sewing, and photography.

Asphalt: A brown or black solid bituminous substance obtained largely as a residue from certain petroleums and which is insoluble in water. It is used for paving, roofing, in paints and varnishes, and in combination with other materials for floor tile.

Astragals: A small convex moulding of rounded surface, generally from half to three-quarters of a circle; a strip of moulding on the edge of folding doors.

Athletic Fields: A specialized type of outdoor recreational area intended primarily for highly organized games and sports, such as football, track, and baseball. Permanent seating facilities are usually provided, and the area is often enclosed by a fence or wall. Athletic fields equipped with permanent seating facilities are referred to as stadiums.

Athletics: Sport activities based on organized competition, requiring a set of rules and a code of ethics, a high degree of skill, conditioning, and training. Examples of athletic contests are college football games, high school basketball games, Amateur Athletic Union track-and-field meets, and intracommunity softball games.

Attractiveness: Aesthetic appeal; beauty in terms of intended purpose.

Auxiliary: An additional, supplementary facility used to supplement the main facility.

Bathing Beach: A tract of land adjoining a lake, stream, or ocean. Facilities provided usually include a bathhouse, playground apparatus, picnic areas, courts for games, and space for parking.

Berm (or Dike): A narrow shelf, path, or ledge, as along the top of a scarp or along a road.

Blinding Glare: Glare so intense that for an appreciable period of time no object can be seen.

Brightness: Luminous intensity created by direct emission of light from a source by transmission through a translucent medium or by reflection from a surface. The unit of brightness is the footlambert.

Brightness Balance: Specified limitations of brightness differences and brightness ratios within the visual fields which, if observed, will contribute toward visual comfort and good visual performance.

Brightness Contrast: The relationship between the brightness of an object and its immediate background.

Brightness Difference: The difference in brightness among the various reflecting surfaces and light sources within the total visual field as measured in footlamberts.

Brightness Ratio: The ratio of two brightnesses in the field of view.

British Thermal Unit: The quantity of heat (252 calories) required to raise the temperature of one pound of water one degree Fahrenheit at or near its point of maximum density (62° to 63°).

Bulkhead: An upright partition separating two parts in protection against fire or leakage, as a wall or embankment holding back earth, fire, or water.

Candlepower: Luminous intensity expressed in candelas (formerly, candles).

Casing: The act or process of encasing a frame, as of a window or a door.

Caulking: A filler for seams or cracks.

Chair Rail: An encircling band on the walls around the room at chair height to protect walls from damage by chairs contacting them.

Chamfer: The surface formed by cutting away the angle formed by two faces of timber, stone, or metal; to furrow, to channel; to flute; to bevel.

Chlorinate: To combine chlorine with water for purification.

Circuit Breaker: A device that automatically interrupts the flow of an electric current.

Climate Control: A term used to include the control of heating, ventilating, and air-conditioning.

Color: A property of light that depends upon its wave length or frequency; any one of the hues of the spectrum.

Color Discrimination: The perception of differences between two or more colors.

Community: A small city or a section of a larger city, primarily a residential area usually composing three to five neighborhoods, representing the service area of a secondary school and containing a business center. The people are held together by psychological, sociological, and economic bonds and may act together consciously or unconsciously in their chief concerns of life. The community creates, as a result of its common interests, certain institutions of legal, protective, educational, recreational, and religious character. A community includes factors of interdependence and belonging and a sense of usefulness through contributing to the common good.

Community Recreational Center: A structure devoted exclusively or primarily to a diversified program of community recreational activities. Such features as a gymnasium, club rooms, social hall, craft rooms, game rooms, kitchen, auditorium, lobby, and service facilities are usually provided. The term "neighborhood center" is often used to describe a recreational center that serves a specific neighborhood.

Competition: Activity involving conscious or unconscious rivalry, in which one person or group tries to gain advantage over the other person or group; involvement of two or more opponents in a contest. This term can also mean rivalry with a previous record of an individual or group. Competition can occur without conflict, as in a friendly game of cards.

Complementary Colors: A pair of contrasting colors which, when mixed in proper proportions, give a neutral color or grey.

Comprehensive Survey: A study that provides an extensive, thorough investigation and analysis of the leisure and recreational pattern of a given locality. It includes an investigation of social, political, economic, and cultural causal relationships that have affected, are affecting, or seemingly will affect the future leisure and recreational services in a specific locality.

Concession: Authority, granted under contract with mutually acceptable provisions by all parties concerned, given by recreation departments to operators permitting them to provide services and/or sell commodities to patrons of recreational areas and facilities.

Condemnation: To pass an adverse judgment on; disapprove of strongly; censure; to prove guilty of wrong-doing; to declare unfit for service or use; to condemn private property for public use; the processes by which government exercises its rights of eminent domain.

Condenser: That which makes dense, concentrates, or compresses.

Convestor: A medium of convection; the transmission of heat or electricity by the mass movement of the heated or electrified particles, such as air, gas, or liquid currents.

Co-recreation: Activities engaged in jointly by both sexes, such as dances, mixed choruses, and hiking.

Cove: A large hollow forming part of an arch in sections joining the walls and floor, or the walls and ceiling of a room.

Creative Recreation: Activities that provide opportunity for production, formation, origination, making new things, or remodeling old things; an outlet for one's creative urge. Arts and crafts, dance, drama, and music are examples of creative recreation.

Crowned Field: A curved field with the summit or highest point (crown) at the middle, running lengthwise. (A football field is crowned for the purpose of drainage.)

Dado: A term applied to the lower portion of walls when decorated separately.

Day Camping: A group experience in the natural environment under trained leadership requiring that the campers be absent from home only during daylight hours.

Deck: A platform or floor, such as a ship or a swimming pool deck.

Design: The architectural form, pattern, or scheme of construction of athletic, physical education, or recreational areas, facilities, and their units.

Diatomaceous: Containing or consisting of diatoms or their fossils (a number of related microscopic algae, one-celled or in colonies, whose walls consist of two parts or valves and contain silica).

Discomfort Glare: Glare that produces discomfort; it does not necessarily interfere with visual performance or visibility.

District: A large geographical planning unit of a large city, comprising a number of communities.

Drama Recreation: Activities that give form and order to theatrical impulses; such activities include the imaginative play of children, charades, pageants, and plays.

Easement: a right or privilege that a person may have on another's land, as the right-of-way.

Eaves: The lower part of a roof protecting beyond the face of the wall.

Economy: Costs kept at a minimum compatible with program needs, durability of materials, low maintenance, and attractiveness.

Elevation: A geometrical projection on a plane perpendicular to the horizon; an elevated place; the distance above or below the zero level or ground level.

Environment: The aggregate of all the external conditions, surroundings, and influences affecting the place or individual.

Equipment: Movable furnishings as opposed to stationary property; relatively permanent articles, furnishings, machinery, and devices used in administering, operating, and maintaining recreational programs and services.

Escutcheon: A shield or plate, as around a keyhole.

Experience: An actual and conscious living through an event, or events, as they occur; anything observed or lived through.

Extrude: To thrust out; to push out or force out; expel; to stick out; protrude; project.

Facade: The face or elevation of a building.

Facilities: Areas, structures, and fixtures essential to accommodate the program.

Familiarization: Programs acquainting the user, as with the water when teaching swimming.

Fascia: A wooden or stone band between moldings.

Fenestration: Windows and all other sources and means of control of natural light.

Field House: A facility providing enclosed and unobstructed space adaptable to various physical education and recreational activities, services, demonstrations, and meetings. It is often located on, or near, a playfield or athletic field. The term also refers to a service building used by people using the athletic field.

Fixture: Something firmly attached, as a part or an appendage, such as a light fixture; equipment affixed to the surface of a building in such a manner that its removal would deface or mar the surface. (Legally, it is the property of the building.)

Flashing: Sheets of metal or other material used to waterproof joints and cages, especially of a roof.

Flexibility: Increase or decrease in kind and amount of use at reasonable cost and effort; a quality of elasticity of the muscles and the connecting tissues in the body.

Flush: Unbroken or even in surface; on a level with the adjacent surfaces; having no indentation.

Fluting: The vertical channeling on the shaft of a column.

Footcandle: The illumination at a point on a surface that is one foot from and perpendicular to a uniform point source on one candela (candle); a lighting term used to denote quantity.

Footlambert: A unit of brightness of a surface or of a light source. One footlambert equals one lumen per square foot. Candelas (candles) per square inch is an optional term for a unit of brightness of a light source. One candela (candle) per square inch equals 452 footlamberts. The candela per square meter is the metric term and will be used more in the future. For "brightness" we now say "luminance (photometric brightness)."

Foot-pound: A unit of energy equal to the amount of energy required to raise a weight of one pound a distance of one foot.

Fulcrum: The support or point of support on which a lever rotates.

Fullers Earth: A clay-like, earthy substance used as a filter medium.

Furring: The leveling of a floor, wall or ceiling, or the creating of air spaces with thin strips of wood or metal before adding boards or plaster; the act of trimming or lining.

Gable: The triangular portion of a wall, between the enclosing lines of a sloping roof.

Gallery: A communicating passage or wide corridor for pictures and statues; upper story for seats.

Glare: The sensation produced by brightness within the visual field that are sufficiently greater than the brightness to which the eyes are adapted to cause annoyance, discomfort, or loss in visual performance and visibility.

Glaze: Any impervious material—produced by fire—used to cover the body of a tile to prevent absorption of liquids and gases, to resist abrasion and impact, or to give a more pleasing appearance.

Glazed Tile: A hard, dense tile that has been glazed to prevent absorption, to increase its beauty, or to improve ease of cleaning.

Gradient: The grade or rate of ascent or descent; a rate of increase

or decrease of a variable magnitude, or the curve that represents it.

Grid: A framework of parallel bars; a grating.

Gutter: A trough or channel along or under the eaves of a roof to carry off rainwater; also around the upper edge of a swimming pool.

Gymnasium: A building or part of a building devoted primarily to group activities such as basketball, gymnastics, volleyball, and dancing. It is equipped with gymnastic apparatus, a court area for playing athletic and game activities, dressing room facilities, and seating arrangements for spectators.

Gymtorium: A combination facility designed to be used as a gymnasium or auditorium. Other combination facilities are cafetoriums (cafeteria and auditorium) and gymnateria (gymnasium and cafeteria).

Handicapped: A person who has less than normal aptitude and/or ability for performing the ordinary tasks of life, or of a particular vocation or avocation. The usual reference is to a person physically handicapped, i.e., who has a specific anatomical or physiological deficiency (poor vision, hearing), but it may also apply to the mentally deficient, maladjusted, or retarded person.

Header: A wooden beam placed between two long beams with the ends of the short beams resting against it.

Health: A state of optimal physical, mental, and social well-being, and not merely the absence of disease or infirmity.

Hearing Disabilities; Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.

Hobby: An engrossing activity to which one frequently reverts and to which he gives his free time, such as stamp collecting, knitting, and gardening.

Hose Bibb: A faucet with the nozzle bent downward and threaded for hose connections.

Humidity: Moisture content of the air expressed in percent of maximum.

Ill and Handicapped: A collective term that includes all those classifications, by authorities, of persons suffering from diseases or disability.

Impulse: Acting briefly and as a result of impulse.

Indoor Center: A building, such as a school, church, or community center, that has the facilities needed to carry on recreational activities.

Instruction: The process of conveying facts or information, ideas, and concepts.

Integral: The result of integrating parts into a whole; necessary for completeness; essential; whole or complete.

Integration: Functional interrelationship; the process of making whole.

Interpretative: Explanatory; a conception of art, writing, program, structure, or concept; used to interpret.

Jamb: A side post of a doorway, window frame, fireplace, etc.

Joint: A place or part where two things or parts are joined together.

Leadership: The ability of one person, or a group of people, to influence others to recognize goals of common interest and to stimulate them to act cooperatively to achieve these goals.

Leisure: To be permitted; a bulk of time; a state of freedom; a minimum of obligation; a physiological and emotional necessity; identified by "when" rather than "how."

Liability: The responsibility of one who is bound in law and justice to do something that may be forced by action; a condition that gives rise to an obligation to do a particular thing, to be enforced by court action; a responsibility between parties that the courts recognize and enforce; an unintentional breach of legal duty causing reasonably foreseeable damage.

License: A formal permission to do something; a document indicating certain permission; freedom to deviate from strict conduct, rule, or practice; generally may be permitted by common consent.

Light: Visible radiation—generally considered to be the electromagnetic radiations of wave lengths between 380 and 780 nanometers, which are the violet and red ends of the visible spectrum, respectively.

Lintel: The horizontal timber or stone that spans an opening, as over doors or windows.

Louver: An aperture or frame with boards fitted in a slatted panel for ventilation.

Lumen: A unit of output of light source or of a luminaire.

Luminaire: Lighting unit, including lamps.

Maintenance: The keeping of recreational areas, facilities, equipment, and supplies in accordance with established standards and existing needs for effective operation.

Marina: A water dock or basin providing secure moorings for watercraft.

Master Plan for Recreation: A long-term guide for the systemic and orderly selection and development of recreational facilities and services over a given period of time. It might be composed of such elements as goals, organizational structure, activity program, areas, facilities, personnel, and financial support.

Milieu: The total environment and surroundings within which an activity takes place. Milieu is frequently used as synonym for environment.

Module: A standard or unit of measurement; the length of some part used to determine the proportions of a building.

Monitor: An instrument used for monitoring; a warning; a reminder; a test for intensity of quality.

Monolithic: Massively solid; single and uniform.

Motivation: The process of initiating conscious and purposeful action. It becomes objectified as an interest and usually leads to action in pursuit of that interest. A psychological interpretation is the application of incentives to an individual or group for whom activity is desired. This term is not to be confused with the psychological term "unconscious motivation."

Mullion: A slender, vertical dividing bar between the lights of windows, screens, etc.

Multiple-Use Areas and Facilities: Physical features designed and constructed to meet the space and facility requirements of several types of recreational activities. A gymnasium is an example of a multi-use facility—designed to serve more than one purpose.

Natatorium: An indoor aquatic facility.

Negligence: Failure to act with reasonable care or prudent judgment under the circumstances involved.

Neighborhood: A segment of a community composed of a residential area in which the people may have common ethnic, social, and economic characteristics. They are generally served by the same elementary school and recreational center. The neighborhood may be bounded by barriers, such as thoroughfares, railroads, and waterways, and by commercial and industrial developments.

Neighborhood Park: A landscaped area with a more or less formal design intended to provide an attractive neighborhood setting and a place for recreational activities.

Neighborhood Playground: An outdoor play center designed to meet the recreational needs of a neighborhood, especially the children from 6 to 14 years old. Playgrounds are ideally located in the center of a neighborhood. An apparatus area, a playlot, a wading pool, and a shelter house are usually provided.

Nonslip: Having the tread so constructed as to reduce skidding or slipping.

Nonslip Tile: Tile the components of which incorporate certain admixtures such as abrasive granules in the body or the surface.

Nosing: The projecting edge of a step; that part of the tread which extends beyond the riser; a stair nosing.

Objectives: Short-range and realizable goals; goals that are more attainable than remote aims, but less attainable than immediate outcomes; attainable goals that guide one's thoughts and actions.

Observation Gallery: A platform or projecting upper floor attached to the back wall or sides of a room designed to permit seeing, watching, and observing.

Opaque: The quality of being impervious to light.

Open Space: A relatively underdeveloped area provided within or near urban development to minimize feelings of congested living.

Orientation: The directional placement of a facility; establishing position.

Outdoor Center: An area designed to provide the space and facilities needed to carry on outdoor recreational activities.

Ourdoor Education: A process—taking place under leadership in natural surroundings—that is in or about the outdoors.

Outdoor Recreation: Any type of recreational activity accomplished in the out-of-doors, such as outdoor band concerts, picnics, outdoor pageants, and outdoor dances. It usually refers to activities performed in the natural environment.

Outdoor Theater: A recreational facility designed to meet the needs for a suitable place to hold outdoor plays, pageants, concerts, and meetings. Outdoor theaters vary in size from those located on a playground to the large community type and are constructed in a natural setting, conforming to the characteristics of the area. Grassy slopes, sodded terraces, cement steps or terraces, or benches serve as seats for the spectators.

Outrigger: Any temporary support extending out from the main structure.

Park: An area permanently dedicated to recreational use and generally characterized by its natural, historic, and landscape features. It is used for both passive and active forms of recreation and may be designed to serve the residents of a neighborhood, community, state, region, or nation.

Park District: A subdivision of state government exercising within its jurisdiction the authority of a municipality. It may operate and maintain parks, recreational programs, police forces, airports and other such facilities and programs as may be designated in the act establishing the district.

Park-School: An area cooperatively planned by school and municipal authorities to provide programs of education and recreation for day-by-day use by the people of a neighborhood or community.

Parkway: Essentially an elongated park with a road running through it, the use of which is restricted to pleasure traffic. The parkway often serves to connect large units in a park system and is rarely found except in large cities.

Peripheral Field: The portion of the visual field falling outside the central visual field.

Peripheral Vision: Vision outside the central visual field.

Permeable: That which can be permeated; open to passage or penetration, especially by fluids.

Physical Education: The science and skill of movement, using all types of sports and physical activities for the following specific purposes; to develop and maintain physical efficiency; to develop useful knowledge and physical skills; to teach students to act in socially useful ways; and to develop skills that may be used for physical recreation.

Pilaster: A rectangular feature in the shape of a pillar, but projecting only one-sixth of its breadth from a wall.

Planning: The development of an organized procedure, including the selection of goals and objectives and the tools of action necessary to carry out these goals. Planning involves taking into consideration the social and physical environment of an area as well as the role that recreation plays in area development.

Platform: A surface that is generally horizontal, flat, and raised, or a philosophical basis for a program of action.

Play: The willful and spontaneous natural expression of people that pervades many of the recreational activities of children and adults.

Playfield: A recreational area designed to serve the needs of a community or neighborhood having a population of 10,000 to 15,000 persons. Its essential features are a community recreational building, areas for sports and games, a playground for children, picnic areas, public parking, and occasionally, a swimming area.

Playground: The basic recreational area in a residential neighborhood, providing a variety of recreation activities for people of all ages, primarily children of 6 to 14.

Playlot: A small area intended primarily for the play of preschool-age children and generally located in the corner of a neighborhood playground or near the center of one or more units of a multiple-family housing development. It is usually equipped with a sandbox, slides, swings, and other playground apparatus. Tot-lots and playlots are synonymous.

Plaza: A small landscaped area rarely more than a block in size and often consisting of a triangle or circle at a street intersection.

Post Sleeves: Metal pipe, installed at ground level or slightly below, that receives posts to facilitate various activities.

Principle: A guiding rule for the planning, construction, use, or maintenance of a ffacility in accordance with its intended purpose; a rule of action or conduct; a fundamental rule; an intellectual concept; a guide to the obligations of right conduct.

Proprietary Functions: Those services performed by a municipality, school, county, or other governmental unit for the specific benefit of the inhabitants of that unit in contrast to a benefit of the general public, or which may be conducted in competition with private enterprise.

Prudent: Care, precaution, attentiveness, and good judgment as applied to action or conduct; capable of exercising sound judgment in practical matters; cautious; discreet in conduct; circumspect; sensible; not rash.

Psychophysical Equipment: Laboratory testing devices used to indicate a variety of abilities related to visual acuity, field of vision, distance judgment and depth perception, color vision, night vision, glare vision, glare recovery, reaction time, and steadiness of hand.

Public Relations: The creation of good will through information and education at every point of contact between the agency and its publics; some of the media used to promote good public relations are printed circulars and reports, program demonstrations, employee contacts, newspapers, radio, window displays, and public addresses; harmonious working relationships to inform, to correct misunderstandings, to change opinion, to gain support, to remove apathy, to modify attitude, to establish confidence, to develop awareness of importance of program, and to develop the partnership concept.

Rabbet: A groove or cut made in the edge of a board, etc., in such a way that another piece may be fitted in to form a point.

Ramps, Ramps with Gradients: In this text, ramps with gradients (or ramps with slopes) that deviate from what would otherwise be considered the normal level. An exterior ramp, as distinguished from a "walk," would be considered an appendage to a building leading to a level above or below existing ground level. As such, a ramp shall meet certain requirements similar to those imposed upon stairs.

Ray: A single line of light coming from a luminous point.

Recreation: To create anew, or to refresh from toil; what we do because we want to do it; recreating the mind and body; wholesome and pleasurable behavior; action motivated by inner desire (no outer compulsion); spontaneity; not ordered, imposed, or forced; the individual has something to choose from and he is capable of making a choice; the motive is enjoyment and personal satisfaction, and the doing of it has its own appeal; the "when" is leisure, the "what" is recreation.

Recreation Areas: Land and water space set aside for recreational usage, such as parks, playgrounds, lakes and reservoirs.

Recreation, Commercial: Recreational services and activities, such as dance halls, bowling alleys, theaters, amusement parks, and carnivals organized primarily for profit and provided by business enterprises.

Recreational Facilities: Buildings and other physical features and provisions, such as swimming pools, community recreational centers, stadiums, and outdoor theaters, designed and constructed for recreational use.

Recreation, Municipal (Public): A program of public recreation provided by the corporate body for persons residing in any one of the several types of governmental units having the power of local self-government. It is financed primarily by taxation and includes the establishment, operation, conduct, control, and maintenance of programs, services, areas, and facilities.

Recreational Museum: An area or facility for preserving and exhibiting recreational objects and artifacts.

Recreation, Private: A recreational program and/or services established under the auspices of an agency or organization supported by other than governmental funds. Private agencies usually serve a particular constituency and often limit their services to a given area of a city and to those invited by the agency. Recreation is often a technique rather than a primary purpose in private agencies.

Recreation, State: A recreational program or service offered by a state agency, such as the state recreation commission, conservation department, or welfare department, on a statewide basis. The services may include operating a public area and facility such as a state park, carrying forth statewide research, planning and promoting new recreational programs, and/or advising local groups on various problems relating to recreation.

Redevelopment: An additional developing process.

Reflectance (Reflection Factor): The percent of light falling on a surface that is reflected by that surface.

Reflected Glare: Glare resulting from specular reflections of high brightness in polished or glossy surfaces in the field of view. It usually is associated with reflections from within a visual task or areas close to the region being viewed.

Reflection Factor: The percentage of light reflected by a given surface.

Refrigerants: Any of the various liquids that vaporize at a low temperature, used in mechanical refrigeration.

Resident Camping: A sustained group-living experience in the natural environment under trained leadership in which the surroundings contribute through program to the emotional, physical, and soial growth of the individual.

Resiliency: Ability to bounce back or spring back into shape or position after being pressed or stretched; elastic.

Resistance: Any opposing friction causing force; the reciprocal of conductance.

230

Riser: The vertical distance (and pieces) between the steps in a stairway.

School Camping: An organized camping program conducted by a school as an integral part of the regular school program and emphasizing outdoor education.

Scuba Diving: Diving with self-contained underwater breathing apparatus (air tank).

Service Building: A structure affording the facilities necessary to accommodate the people using recreational facilities such as a golf course, swimming pool, or ice-skating rink. It may contain dressing rooms, lockers, toilets, shower rooms, check and storage rooms, a lobby or lounge, and a repair shop. Also, the term is used in reference to buildings that facilitate the operation and maintenance of the recreational system, such as greenhouses, storage buildings, and garages.

Shadow: The space from which light from a given source is excluded by an opaque object; the area of comparative darkness resulting from the interception of light by an opaque object.

Sheathing: The inner covering of boards or waterproof material on the roof or outside wall of a frame house.

Shelter House: A building, usually located on a playground or playfield, equipped with such features as an office for the director, space for storage, toilets, and a craft or play room.

Short-Term Residence Camp: A creative, cooperative experience in living in the out-of-doors in self-sufficient small groups for periods of five days or less.

Sill: A heavy horizontal timber or line of masonry supporting a wall; a horizontal piece forming the bottom frame of a door or window.

Sleeper: A piece of timber, stone, or steel, on or near the ground to support some superstructure.

Social Recreation: Activities or experiences primarily engaged in to produce sociability, such as parties, banquets, club meetings, picnics, and dances. Social recreation uses as a medium the activities of sports, games, drama, music, dance, nature recreation, and arts and crafts. The motivating purpose is to bring people together.

Soffit: The ceiling or underside of any architectural member.

Special Recreational Areas and Facilities: Areas and facilities designed, constructed, and equipped to meet the requirements of a specific form of recreational activity, such as a golf course, swimming pool, and athletic field.

Specifications: Detailed description of the parts of a whole; statement of enumeration of particulars, as to size, quality, and performance; terms; something specified.

Sports Recreation: Activities that usually require a great deal of physical movement and the use of specific equipment and areas. Examples are golf, tennis, hunting, fishing, skiing, and corecreational softball. Athletics and sports are not synonymous; athletics is one of the many kinds of sporting activities frequently referred to as physical recreation.

Staggered: Arranged so that alternate intervals of space or time are used.

Stanchion: An upright bar, beam, or post used as a support; one of a pair of linked, upright bars.

Standards: Norms established by authority, research, custom, or general consent to be used as criteria and guides in establishing and evaluating programs, leadership, areas, facilities, and plans; as measures of quantity, quality, weight, extent, or value.

Stile: A vertical piece in a panel or frame, as a door or window; a set of steps used in climbing over a fence or wall.

Supervise: Oversee or manage a program, activity, or people, and arrange for economy of control and management.

Survey: A cooperative undertaking that applies scientific methods to the study and treatment of current recreational data, problems, and conditions. The limits of a survey are prescribed before execution and its facts, findings, conclusions, and recommendations are made common knowledge and provide a base for intelligent, coordinated action.

Synthetic: Artificial; not real or genuine; a substance produced by chemical synthesis.

Tanbark: Any bark containing tannin (used to tan hides) and, after the tannin has been extracted, it is used to cover tracks, circus rings, and dirt floors in field houses.

Template: A short piece placed in a wall under a beam to distribute the pressure; also a beam spanning a doorway, or the like, and supporting joists.

Terra Cotta: Clayware having the surface coated with fine slip or glaze; used in the facing of large buildings for relief ornament or statues.

Terrazzo: A type of flooring made of small chips of marble set irregularly in cement and polished.

Threshold: A piece of wood, stone, metal, etc., place beneath a door; doorsill; the entrance or beginning point of something; the point at which a stimulus is just strong enough to be perceived or produce a response, as the threshold of pain.

Topography: The configuration of a surface, including its relief; graphic delineation of physical features of any place or region.

Translucent: Transmitting light but scattering it so that details cannot be distinguished through the translucent medium.

Transparent: Allowing light to pass through so that objects behind can be seen distinctly.

Truss: To support or strengthen with a constructural truss; a bracket or modillion.

Underpinning: A supporting structure of the foundation, especially one placed beneath a wall.

Unglazed Tile: A hard, dense tile or homogeneous composition deriving color and texture from the materials of which it is made.

Utility: The degree to which an area, facility, or instrument is designed to serve its purpose, and the degree to which it is used; percent of usage during the workday adapted or available for general use or utility.

Validity: The degree to which an item or instrument actually does what it is intended to do.

Vestibule: A passage hall or chamber between the outer door and the interior of a building.

Vinyl Tile: Asphalt tile impregnated with vinyl.

Visual Task: Conventionally; those details and objects that must be seen for the performance of a given activity, including the immediate background of the details or objects.

Vitreous: Of, pertaining to, or derived from glass; like glass, as in color, brittleness, and luster.

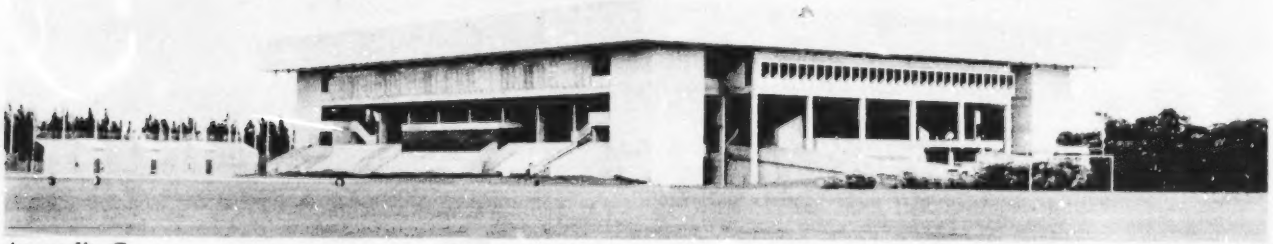
Wainscot: A wood lining or paneling on the lower part of the walls.

Walkway: In this text, a predetermined, prepared surface; exterior pathway leading to or from a building or facility, or from one exterior area to another, placed on the existing ground level and no deviating from the level of the existing ground immediately adjacent.

Wilderness: A rather large, generally inaccessible area left in its natural state available for recreational experiences. It is void of development except for those trails, sites, and similar conditions made by previous wilderness users. (No mechanical transportation permitted.)

Youth Center: A recreational building designed primarily to be used by adolescents. The center may operated by a public or private agency or by a teen-age organization under adult guidance.

Zone Heating: Climate control placed in a building by area.



Appendix D

ANNOTATED BIBLIOGRAPHY
GENERAL REFERENCE

Abramson, Paul. "Educational Construction: A Statistical Summary, 1976 and Beyond". **American School and University** 49 (April 1977): 26-33.
This detailed summary lists the building construction undertaken by schools ranging from the elementary school through the 4 year college. The summary covers the years 1974-1976. Projections are also listed for the years 1977-1979. The special facilities listing indicates that construction of gymnasiums and outdoor athletic facilities has risen since 1974.

"A Comparative Approach to Design-Build". **American School and University,** February 1977, pp. 20-21.
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American Association for Health, Physical Education and Recreation. **Dressing Rooms.** Washington, D.C. 1972.
The publication identifies significant consideration in the planning of dressing locker rooms and related service facilities. Comprehensive treatment of each aspect has not been attempted. Used in conjunction with listed references and up-to-date information available from architects. This material should provide a sound foundation for planning those costly and important facilities.

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Bareither, Harlan and Schillinger, J.L. **University Space Planning,** Univer[illegible]Illinois Press, Urbana, Illinois, 1968.

Bron[illegible]obert T. "Guidelines in Facility Planning". **Scholastic Coach** 46 (January 1977).
Discussion relating to interests and needs of students and the responsibilities of developing and implementing a master plan to fit those needs. Emphasis is given to a step by step plan to eliminate pitfalls of new facilities.

Bronzan, Robert T. **New Concepts in Planning and Funding Athletic, Physical Education and Recreation Facilities.** St. Paul, Minnesota. The Phoenix Intermedia, Inc. 1974.
A complete book on planning new facilities. It incorporates many areas, including financing, justifying new facilities, philosophies, indoor and outdoor facilities. Included also are examples of modern P.E. facilities.

Bronzan, Robert T. "Planning and Securing Funds for Athletic Facilities". **Athletic Purchasing and Facilities** 1 (April-May 1977).
This article discussed the importance of developing a sound public relations program throughout the community and the financial rewards of such a program.

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Coates, Edward. "The Role of the Physical Educator in Facility Planning". **The Physical Educator** 28 (May 1971): 74.
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This article gives major guidelines for the raising of funds and other needs when considering additions and for building new facilities.

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This article relates the tradition of sharing facilities between the public and private sectors thereby creating a city-wide complex in Rochester, New York.

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Gans, Marvin, **Sequential Steps in Planning Facilities for Health, Physical Education, Recreation, and Athletics,** PhD. Thesis at University of Utah, 1972.

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The author suggests that landscaping is not a luxury but should be considered a necessity for a complet facility. Ground cover plantings can be an asset over turf.

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Penmna, Kenneth. **Planning Physical Education and Athletic Facilities in Schools.** John Wiley and Sons, Inc., N.Y. 1977.

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"Quick, Tell Me How To Buy Athletic and Playground Equipment". American School Board Journal 164 (February 1977).
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INDOOR FACILITIES

AIR STRUCTURES

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The balloon type bubble is a simple air-supported structure. The boat type is just inflated tubes or panels to make an air-inflated structure. The Fuji Group Pavilion is the third type of bubble called a hybrid air structure which has external walls or framework. All of the bubble types may be used extensively for recreation, campus sites and methods to fight pollution.

"Fabric Roof Tops A Permanent Structure". **American School and University** 48 (August 1976).
The roof of the field house at Charles Academy is made of non-degradable materials. the actual structure off the building is cement with a fabric roof. The fabric roof results in only 10% of the total cost of the field house, which was built for $588,000.

Hill and Knowlton. "Air-Supported Structures". **Scholastic Coach** (January 1974): 15, 103-104.
A new steel cable reinforced air-supported structure can now be expected to last for 20 or more years. The structure can be up to 600' long, 120' wide, and 48' high. The structure can be a variety of architectural styles and the cost is lower than the traditional building costs.

Katz, Anthony W. "Air Structures Expand to Meet Your Needs". **Recreational Management** 33 (April 1976).
This article describes various air supported structures in terms of their advantages and disadvantages.

"A Profile of the Two Largest Air-Supported Roofs". **Architectural Record** 159 (January 1976): 141-144.
A detailed study of how the two cable restrained, air-supported roofs at Pontiac, Michigan Metropolitan Stadium and the University of Northern Iowa Dome were constructed. Lower construction costs (than rigid roofs), the translucency of the fabric and the self-cleaning property of the fabric were cited as advantages of such a design.

Puckett, John. "Two Promising Innovations In Physical Education Facilities". **Journal of Health, Physical Education, and Recreation** 43 (January 1972): 40-41.
"Shelters or limited shelters" and air-supported structures are briefly discussed for consideration as facilities for physical education. Selected examples and basic specification of shelters are cited, especially for elementary school use. Air-supported structures are explained including the new types of anchorage systems, characteristics of the structures, and the cost.

"Sliding On Air". **Time** 106 (September 1975).
This article describes the new Aloha Stadium in Honolulu, Hawaii and its revolutionary ability to change its shape and purpose by sliding its stands on a cushion of air.

Theibert, Richard. "Air supported Structures, Coming On and Going Up Fast". **Scholastic Coach** (January 1974): 13-15, 98-99.
Bright prospects for this type of structure are mentioned. Top manufacturers are also listed, along with steps on how to put this type of structure together.

"World's Largest Air-Supported Structure". **American School and University** 47 (July 1975): 23.
This article describes the activities center at the University of Santa Clara, which is the world's largest permanent air supported structure. It talks of the roof, safety, energy conservation and lighting.

AUXILIARY AREAS

Brown, Robert. "Multi-Purpose Facilities". **American School and University** 47 (November 1974): 23-27.
The multipurpose concept for stadium areas is discussed in this article. A study for the University of Minnesota is discussed to illustrate how one facility can host eight different sports on the same surface just by changing the markings on the field.

Brubaker, W.C. and Hutchinson, George. "New Life for Old Buildings". **College and University Business** 52 (January 1972).
This article outlines several possibilities to give old buildings a new life such as renovation of existing buildings for some other educational function and for the same function, and remodeling of other non-educational buildings for new college roles.

Dotter, Richard L. "The Multipurpose Challenge". **Journal of Health, Physical Education and Recreation** 37.
The author presents both advantages and disadvantages of the multi-purpose room used for physical education, and other things, such as cafeterias and auditoriums.

Keene, Charles. "Using Balconies in PE Programs". **JOPER** (April 1977): 64.
This article discusses ways to use existing space for the teaching of physical education. Ideas for limited space units and safety precautions are suggested.

"Making the Most of Multi-Use Space". **American School and University** 39 (September 1966): 33.
Because many schools today cannot afford separate facilities for physical education, eating and/or plays, the multipurpose

room would seem to be the answer. With today's light, portable furniture, rooms may serve double or even triple duty.

"Mixing Media". **The Architectural Forum** 138 (May 1973): 30.
This article concerns the new multipurpose auditorium and arts center for Dickinson College. The arts building will accommodate studios, and offices for art, dance, music and lounges for exhibition space.

"Music, Drama, PE, All In One Facility'. **Scholastic Coach** 45 (January 1976): 20.
An excellent example of organized planning between the architect, school administrators and staff with a rewarding result because of their efforts.

"OSU Puts Sports Where the Students Are". **American School and Uniersity** 49 (December 1976).
With available monies, Ohio State University build satellite multipurpose recreation centers around the university campus. Advantages such as great student access, inexpensive construction and minimal maintenance are discussed. General structural points are revealed.

"Planning a Classroom Fitness Center". **Physical Education Newsletter** (April 1976).
This article describes how an elementary physical education instructor in Rhode Island adapts physical education to the open elementary school classroom by setting up a fitness corner on a free standing portable wooden frame.

Pollock, Alexander. "Multi-Use Stadium Prototype". **Scholastic Coach** 41 (January 1972): 22, 40.
This type of multi-use stadium is designed both for school and community use. It provides several outdoor spectator areas for a wide range of sporing events as well as agricultural fairs, religious convocation and horse shows, plus the already existing indoor facilities such as a pool, gym, locker rooms, training rooms and classrooms. It is a design of the future with a total cost of about $5,000,000.

Rainey, T. Marshall. "Hidden Teaching Stations". **Scholastic Coach**42 (January 1973): 7.
Various suggestions concerning the maximum use of physical education buildings and facilities are discussed in this article. The author relates many uses for the "cage" (field house), natatorium, arena, ice rink, locker rooms and laundry facilities.

Steen, Barney. "Side Wall Accessories". **Scholastic Coach** 41 (January 1972): 42.
The article describes the portable side walls which Calvin College built to help increase their facilities for both handball and paddleball. The 5 portable walls gave them 4 new courts in the balcony of the gymnasium.

Stevenson, Ian T. "A Jumping Complex". **British Journal of Physical Education** (June 1973): 43.
Here is a suggestion for a multipurpose jumping complex which has attempted, at low cost, to incorporate all the major athletic jumping events into one unit specifically designed for teaching.

Theibert, Richard P. "Facilities for Lifetime Sports". **American School and University** (November 1971): 14-18.
Explains the problems of designing facilities for athletics and expecting them to accommodate physical education and intramurals. The "open space" concept to accommodate a large variety of activities is discussed. Stresses area and facility for lifetime sports.

COURT GAMES

Bigham, J.H.L. "Multipurpose Courts for All Seasons". **Parks and Recreation** 8 (May 1973).
Article discusses the reason for and the basic design needs of a multipurpose court. Possible locations for such a facility are also mentioned.

"Bloody Courts, Bloody Weather". **World Tennis** 24 (August 1976).
The author relives some of the memories of the British Hard Court Championships with explicit comments on the less than adequate facilities.

"Building For Sport: Uptown Racquet Club". **Architectural Record** (February 1977): 115-117.
This article deals with the growing boom in tennis, squash, and racquetball. It specifically tells of one racquet club in New York that was built over, under, and alongside an existing department store. It contains 14 singles courts, a nursery, restaurant, saunas, and other facilities. It is the largest commercial club of its kind in the U.S.

Dudas, William L. "New Standards for Volleyball". **Athletic Journal** 56 (May 1976).
This article gives up-to-date design for efficient volleyball standards with safety and rule specifications as a primary objective in their construction. Diagrams and illustrations are included.

Flynn, Richard B., "Indoor Racquet Clubs". **Joper,** Vlume 48, Number 9, 1977 p. 45.
A discussion of the recent trends in the building of racquetball clubs.

Knight, Pamela. "Fold It Out and Presto: Tenderloin is Hamburger". **Sports Illustrated** 38 (March 26, 1973): 72-73.
Since Squash is becoming more popular in the United States, facilities must be made available for participants. One suggestion for present unappropriate gymnasiums is a preassembled box-like structure made of stressed skin plywood panels which fold open and closed. It is estimated it would cost $8,500 per unit.

"Paddle Tennis: Holding Court on Today's Campuses." **American School and University** 48 (June 1976).
Platform tennis, a smaller, more convenient and faster version of tennis is a growing sport in the midwest and northern parts of the country. This article gives court dimensions and describes some of the different designs and materials being used to construct new courts.

Penman, Kenneth A., "Do's and Don'ts in Constructing Handball-Racquetball Courts" **Athletic Purchasing and Facilities,** Volume 2, Number 3, 1978, p. 24.
Article emphasizes important points to consider when constructing handball-racquetball courts.

"Platform Tennis Builds New Interest into Employee Recreational Facilities." **Recreation and Management** 20, (March 1977).
This article validates the inclusion of two platform tennis courts into the United States Automobile Association's new recreational facility in San Antonio. Specifications concerning rules, facilities, and maintenance required are included.

Taub, Deborah. "Boca West: Tennis Without a Racket." **Tennis Directory,** Volume 2, Number 2, 1978, pp. 18-21.
Contains information on innovative features of a recently developed resort club.

Van Dis. "Handball Courts in Future YMCA's." **Journal of Physical Education** 70 (January-February 1973): 40-41.
After explaining why YMCA's, for monetary reasons, have not built handball courts, the author goes on to give suggestions for adaptability of handball courts to other activities. He also talks about the need for spectator space and how it should be developed. On the page next to the article are diagrams illustrating handball court designs.

DOMED STADIUMS

"A Dome Amidst the Hexagons." **American School and University** 48 (August 1976)
A prefabricated dome was built over a gym in a South Carolina H.S. The building contains 12,000 square feet of interior space and seating for 1,000 spectators.

Davis, William E. "A Stadium For All Seasons." **College Management** 7 (February 1972): 21-24.
Nicknamed the "Minidome," this new complex at Idaho State University was a winner from the time of completion. The building houses a stadium of 12,000 seats, dressing and locker rooms, offices, concession stands, rest rooms, a football field, portable basketball court and board track, and a portable stage. This article describes the steps taken in selling, planning of the building, and also equipment selection.

"Dome Provides Beauty and Low Cost Space." **American School and University** 48 (January 1976).
The geodesic dome built at the Community College of Beaver County, PA is the first public geodesic dome in the state. Center height measures 67 feet and provides 38,000 sq. feet of floor space. It is designed to withstand the weight of 4 feet of snow, and 125 mph winds.

"Geodesic Dome Shipped 3,000 Miles to Construction Site." **School Management** 15 (September 1971): 45.
A brief review of how quickly and inexpensively a geodesic dome can be shipped and erected. This dome will house ice hockey and can be converted to a number of activity areas for the school and community.

Green, Leon G. "The Kibbe Dome: Idaho's Indoor Innovation." **Athletic Administration** 6 (Fall 1976): 21.
The Kibbe Dome was built at the University of Idaho to house

football due to the area's fall weather conditions. Because of the nature of the building, it is now being set up to be used as a multi-purpose building which can handle just about any indoor activity.

"Notre Dame's Twin Domed Wonderland." **Scholastic Coach** 39 (January 1970): 20.
Notre Dame's 8.6 million dollar convocation center is one of the 2 or 3 wonders of the college sports world. The twin domed complex is 750 feet wide, 630 feet deep, and contains 460,000 sq. ft. of air-conditioned space. Virtually every sport, varsity club and intramural can play or practice somewhere in the superb complex.

Parker, Donald W. "Walla Walla Community College Geodesic Dome." **Athletic Purchasing and Facilities,** Volume 2, Number 7. December 1978.
A new building designed for energy conservation.

"Prefabricated Dome Solves A College Budget Problem." **American School And University** 48 (August 1976).
After 10 months of planning and a few months of construction at Mississippi College, a new gymnasium called "The Coliseum" is nearing completion with a cost of only $27.75 per sq. ft.

Reed, J.D. "Really Running In The Red." **Sports Illustrated** 48 (March 1976).
Although political and businesslike in nature, this article says much about planning and effectively running a large sports area, the Louisiana Superdome.

Schmidt, Lawrence W. "New Athletic Programs Fill Three Domes." **Athletic Purchasing and Facilities** 1 (April-May, 1977): 42-46.
Three golden domes were fabricated and erected from components by Temcor, a building systems manufacturer specializing in geodesic domes. The need for an indoor ice rink in this hockey conscious community helped contribute to this decision. The integrated design of the domes leaves no girders or rafters to hang lighting; instead, lights were placed in towers at the perimeter of each dome and are beamed at the ceiling.

"Sports Dome Offers Something for Everybody." **American School and University** 49 (December 1976): 30-31.
The indoor facility at the University of Northern Iowa is a football stadium, basketball and track stadium, etc., besides being an auditorium, physical education and intramural building. This multi-purpose structured facility was constructed for $7 million, a savings of $15 million to UNI. The dome of the facility is woven fiberglass which is kept up by four air blowers and a network of steel cables.

"Spreading Idea: Domed Stadiums." **U.S. News and World Report** (September 1975).
This article discusses the present trend in stadium building, domed stadiums. It talks about the oldest and cheapest at Houston, to the newest and most expensive at New Orleans.

"Superdome's Seating." **Architectural Record** 159 (April 1976).
The Superdome in Louisiana can be used for both sports and other forms of entertainment. Movable grandstands on the first level is the main topic of discussion.

"The Elmira Story: Three Geodesic Domes and a Natatorium." **Scholastic Coach** (January 1975): 20-21, 80.
This article discusses the domes' individual uses and also the use of the natatorium. Besides the aestetic qualities, they are also multi-purpose. The article also includes the type of heating and ventilation used in these domes.

"The Only Domed High School Field House In Washington." **Scholastic Coach** 42 (January 1973): 16.
This article describes Washington High School, eight miles south of Tacoma, Washington. The structure has a triax dome with a light strip around the sides. There is a 90 x 94 foot basketball area surfaced with Tartan over a concrete slab. The author describes the other surfaces under the dome, the track, illumination, and heating. The locker room basket facilities are also described.

"The NAU Ensphere: A New College Community Asset." **Athletic Administration,** Volume 12, Number 3, 1977, p. 10.
Is a descriptive outline of Northern Arizona's 502 foot diameter domed stadium.

FIELD HOUSES

"Facilities That Reach Out and Say, 'Lafayete, We Are Here.'" **Scholastic** (January 1974): 12-13, 93-94.
Discusses the design and use of the areas in the Allen P. Kirby Field House at Lafayette College.

"Lightweight Column-Free Membranous Field House." **Scholastic Coach** 44 (January 1975): 22.
New techniques in architecture provide much space at relatively low cost at Graceland College, Lamoni, Iowa. Obstruction-free 40, 435 square feet of space is provided at a cost of $15.91 per square foot.

"Multi-Purpose Mammoth." **College Management** 5 (August 1970): 18-21.
Because of the climate, St. Lawrence University, New York, has limited outdoor ahtletic activity. The Athletic Department constructed a 160 x 260 building which enclosed a one-tenth of a mile track, a tennis court, and 20,000 feet of practice area inside the track.

Peterson, Alex. **Guide for Planning The Fieldhouse at a College or School Physical Education Facility,** Columbia University, N.Y. 1969.

"Product Applications." **American School and University** 45 (June 1973): 58.
This short article describes the liberal open design of the Parkview Junior High School in New Castle, Indiana, the new field house at the Thomas Jefferson High School in Arlington, Virginia, the use of aluminum seating at Hermitage High School in Richmond, Va., and the new indoor tennis courts at Yale University. Although this article is basically an advertisement, it allows the reader to look at some of the new innovations in the area of athletic and physical education facilities.

GYMNASIUMS

Aase, Kermit, "The Corner Gym." **Journal of Physical Education and Recreation,** 47, (September, 1976).
This article deals with a piece of apparatus called the "corner gym." It can be adapted for various types of exercises and for all grade levels. It is especially useful when lack of space is a factor in planning new facilities.

Austin, Dean A. "Use Your Gym For Tennis Practice." **Athletic Journal** 53 (December 1972): 10, 50-52.
The athletic director at the University of Wisconsin discusses the total use of the gym and its facilities for the improvement of the student's tennis game. He suggests the use of the weight room for building strength, handball for eye-hand coordination, jumping rope for endurance, and running and foot shuffle drills to improve agility.

Byrnes, John N. "Selecting the Right Gym Floor." **American School and University** 48 (April 1976): 38-41.
Is one surface better than another? This article discusses the merits and myths of both synthetics and maple flooring.

"Gigantic Gym." **Nation's Schools** 2 (February 1975).
This article describes how the University of Minnesota built five levels of athletic facilities beneath the stadium seats.

"Gymnasium In The Round." **American School and University** 43 (June 1971): 24.
Circular gymnasium at Ann Arbor Huron High School with a domed ceiling. It is a three level structure that can seat 4,000 people. On the dome, a material named "Tectum" was used as a forming material while concrete was poured. Tectum also serves as an attractive ceiling.

"Here and There". **Athletic Journal** 53 (January 1973): 4.
The new gymnasium at the Union High School in Bellows Falls, Vermont has one 15,600 square foot facility without the usual folding partition separating the girls from the boys. On the few occasions when a partition is desirable, the bleachers, which are movable and have a solid back are utilized.

"Indoor Track Without a Facility". **Scholastic Coach** 44 (January 1975): 60.
A very interesting article on the utilization of a gymnasium for an indoor track facility. In detail, it described the formation of the track, placement of the starting blocks, high jump, long jump pit and pole vault pit. Equipment is inexpensive and easily movable. The program is an excellent example of imagination and multi-use.

Leeper, Terry. "The Round House". **Journal of Physical Education and Recreation** 47 (September 1976).
This article explains the facility and program at Marshalltown H.S. in Iowa. The round gymnasium includes 3 basketball courts; seating for 4,500; a weight room; 1/10 mile track; 6 lane, 25 yard pool and locker facilities.

Pettine, Alvin M. "Planning a Gymnasium". **JOPER** (October 1973): 58-62.
This article deals with the specifics of building a gymnasium. It stresses the important role of the physical educator working

closely with the architect in planning the roof, floor, walls, lighting and acoustics of a new gymnasium.

Puckett, John. "Gymnasium Specifications for Elementary Schools". **Journal of Physical Education** 70 (September-October 1972): 251.
A general overview of this Auburn University professor concerning the planning of indoor activity areas in elementary schools. It is particularly noted that consideration to the community recreation facilities must accompany the primary concern for health and physical education facilities.

"South Adams Double-Decked Gym Plant". **Scholastic Coach** 44 (January 1975): 18.
This article describes the flexibility and multi-use of the South Adams High School Gym. The octagonal gym consists of a main court and an upper deck. The facility includes folding bleachers, swimming pool, exercise and weight room, wrestling room, and 17 teaching stations. The octagonal shape owes itself to a running track on the upper level.

"The Astronaut's Insulated Steel Gym". **Scholastic Coach** 35 (January 1966): 7.
The astronaut's insulated steel gymnasium in Houston, Texas is 70x122' and is equipped with squash and handball courts, apparatus, and areas for various court and net games.

Toman, Thomas G. "New Equipment Features Horizontal Ropes". **Journal of Health, Physical Education and Recreation** 44 (March 1973): 61.
A new piece of equipment invented by the author which uses horizontal ropes that can be attached at various heights and levels.. Incorporates other apparatus too, such as ladders, swings and rings. It has five student activity stations so it can be used by many students at any one time. This type of apparatus emphasizes arm and shoulder strength.

HANDICAPPED STUDENTS

Buch, Judy. "Designing Parks for the Handicapped". **JOPER** Volume 49, Number 4 1978, p. 24.
Making current facilities and park equipment accessible to the handicapped individual.

Buchter, Robert Alan. "Unusual Three Pool Complex Designed for Deaf Children". **Swimming Pool Weekly 1970 Date and Reference Annual** (September 1969): 40-43.
A pool complex for a physical education facility at the Mili Neck Lutheran School for the Deaf was designed to handle the problems of children with no hearing ability. Flashing rows of signal lights and pools on three different levels were among the devices used. The design of the building also had to allow for easy access from a massive mansion which had been converted into the actual school setting. A listing of the construction details follow the article.

DeGaff, Alfred. "Entrances, A Big Problem for Handicapped Students". **American School and University** 48 (December 1975).
This article gives a thorough explanation of automatic doors and sizes of doorways that will replace the conventional door for newly constructed buildings to provide the handicapped access to facilities.

Edwards, P.R. "English Pool for Blind Proves Value". **Swimming Pool Weekly 1970 Data and Reference Annual** 43 (September 1969): 31-32 39.
Even though the Royal Normal School for the Blind at Rowton Castle, England, cost $84,000, the school justifies the expense with a most successful teaching program. The article explains the various designs which are advantageous in a pool for the handicapped such as a sound directional air, floor tiles of varying braille-like textures, handrails, sloped runs, and floating guidelines.

Ersing, Walter F. "Guidelines for Designing Barrier-Free Facilities". **JOPER,** Volume 49, Number 8, 1978, pp. 65-67.
Provides insight into basic guidelines for facility construction for accessibility.

Gordon, Ronnie. "Playground Can Be Experience Equalizers". **American School and University** 45 (June 1973): 37.
The Jessie Stanton Developmental Playground for Pre-School Handicapped Children has an experience philosophy behind it. A map of the playground is presented as well as a picture. The details for the "bridged treehouse" the "foam and sand pits", and the "water and tables" are given in depth.

Jansma, Paul. "Mainstreaming". **JOPER,** Volume 48, Number 7, 1977, p. 76.
An attempt to explain our responsibility to the handicapped when building facilities since the implementation of Public Law 94-142.

Levy, Paul H. "USC Opens Up To The Handicapped". **American School and University.** September 1978, pp. 72-74.
Deals with USC's attempts at making its sports facilities accessible to the handicapped student.

"Making Physcial Education and Recreation Facilities Accessible to ALL". Athletic Purchasing and Facilities, Volume 2, Number 2, 1978, p. 37.
Contains information on the construction of facilities with the handicapped student in mind.

The University of the State of New York. **An Instructional Playground For The Handicapped.** The State Department of Education, New York, 1976, pp. 1-53.
This is a manual of guidelines for the construction of playgrounds for the handicapped child.

Zucker, Ken. "Accessibility: How One Department Is Making It Possible". **Parks and Recreation.** (June 1976): 24-25.
Article tells how L.A. County Dept. of Parks and Recreation renovated structures to make them accessible to the disabled. Ten steps were listed that indicated some of the things the department did to eliminate barriers.

INDOOR TENNIS

Alschuler, Alfred S. "Building Quality Tennis Courts". **Parks and Recreation** 5 (October 1970): 27.
The author stresses factors that are important for park and recreation personnel to consider before building tennis courts. Such things include: types of surfaces, location, design and equipment. Several sources are listed in the article where a person can write to and receive additional information.

Amdur, Neil. "So You Want To Build An Indoor Club". **World Tennis** 24 (April 1977).
This article presents an operating statement chart for the Columbus Indoor Tennis Club covering a comparison of 1975 and 1976 expenses. An overview of establishing, operating and maintaining such a facility is also included.

Austin, D.A. "Gymnasium Adaptation for Indoor Tennis". **Athletic Journal** 52 (February 1972): 16.
The author illustrates a very sound and safe method of adapting a gym facility for use as a tennis facility. The specialization in sport today and the limited weather in the north makes such an adaptation necessary.

Blair, John S. "Tennis On A Tank". **Parks and Recreation** 12 (February 1977): 35.
Due to the lack of flat open space in the Colorado Rockies, the community of Evergreen has used the top of its sanitation digester for two tennis courts. This unique idea only cost $12,000 for the two courts and has enabled the community to develop a new racquet club called Sew'R Racquet Club.

"Costing An Indoor Tennis Building". **Architectural Record.** 159 (March 1976).
This article consisting mostly of tables and charts, show the cost of building an indoor tennis facility. Two major areas covered are the entire building system and space planning guide.

Johnson, Walther A. "The Nielson Tennis Stadium". **JOPER** 41 (May 1970): 36.
The University of Wisconsin has an indoor facility which contains 12 tennis courts, five singles squash courts, and one doubles squash court, completely enclosed. With air cooling, diffused lighting, and resilient surfaces, these courts provide year-round day and night participation.

Peterson, G. "Winter Tennis For Fun and Profit". **Parks and Recreation** 10 (January 1975): 37-38.
This article describes a tennis facility in New York City that consists of 15 courts. During the summer it is run by the city. During the winter it is operated by a private corporation, when two air-supported domes are erected over ten courts. Considerations for such a program are given.

Soden, John W. "Planning An Indoor Club". **Tennis Industry** 1 (May 1973): 10.
This article discusses comprehensive guidelines for building and operating an indoor tennis club. It covers sites, court building, surfaces, lighting systems, heating, cooling, lobbies, reception areas, pro shop, and other areas.

"Tennis USA's Guide to The National Tennis Center". **Tennis USA** Volume 41, Number 8, 1978, pp. 34-35.
Contains a discussion of the newly developed USTA National Tennis Center.

LAUNDRIES

Masin, Herman L. "On-Premise Laundries". **Scholastic Coach** 46 (January 1977): 42.
The many benefits of laundering athletic and physical education clothing in school versus sending the laundry out are discussed. The needs for developing such a laundry facility are revealed, along with helpful questions on the selection of proper laundry equipment.

Selway, C. Philip. "Equipment and Laundry Rooms". **Scholastic Coach** 34 (January 1965): 30.
The author outlines the procedures of organizing and running equipment and laundry room facilities at the University of Delaware. Many helpful hints are presented relative to selecting, buying, repairing and inventory of the equipment.

Sprague, Vernon S. "Cost Factors For Institutional Laundry Services". **JOPER** 42 (February 1971): 41-42.
Based on the state universities and colleges in the Oregon State System of Higher Education, this article compares the costs of an institutional laundry to those of a commercial firm. It appears that a physical education department can launder clothing at approximately ⅓ the cost of a commercial laundry. Advantages, other than economics, are also discussed.

LOCKER, SHOWER, AND DRESSING AREAS

Crieder, Calvin. "Carpet Tiles: Plus and Minus, A Switch In Time Saves Wear and Tear". **Nation's Schools** 92 (February 1973).
This article discusses the initial cost, appearance factors, installation, maintenance and other areas of concern about the use of tile carpet in the locker room area.

"Detail of Suggested Locker and Bench Installation". **A Guide For Planning Facilities** p. 62.
This article shows a diagram of a feasible locker system and its installation. It also deals with towel service and storage, toilet rooms, storage rooms, as well as dressing lockers.

Dickey, Donald. "Choosing The Right Athletic Locker For Schools and Colleges". **American School and University** 39 (August 1967): 35.
The author tells us what to look for prior to purchasing athletic lockers for the school. Locker construction, color, latching devices, number plates, and how to order lockers must be taken into consideration.

Woods, John B. "Dressing Up the Dressing Room". **Athletic Journal** XLVIII (February 1968): 64.
Woods describes how the addition of a commercial carpeting in the locker room will aid in appearance, maintenance, and hygienics.

NATATORIUMS

"A Splash Safer". **American School and University** 49 (March 1977).
This article describes a $120,000 renovation of a swimming pool at Riverside Brookfield H.S. in Illinois. Briefly described are the alterations in length and depth, the gutters, the concrete, tiling, and lighting. The end result was a nicer, new, and safer pool.

"Cutting Costs With Automated Swimming Pool". **American School and University** 48 (June 1976).
This article discusses the advantages and savings associated with automation; in this case a swimming pool. Savings are in areas of labor, maintenance, chemicals, overhead and electricity. Advantages include better quality water and better safety control. Although the article is primarily concerned with automation, it brings out a good point related to sharing facilities.

"From East and West: Two Indoor Swimming Pools". **American School and University.** 39 (August 1967): 29.
This article describes Pacific Lutheran University's "T-shaped" pool with glass walls on three sides and Central Connecticut State College's Natatorium, in which seven locker room and shower room areas lead to the swimming pool deck.

Horgan, Tim. "Ohio's New Swimming Pool Rule". **The Sounding Board** (Summer 1977): 9-11.
This article details the new swimming pool rules for the state of Ohio, which went into effect on January 1, 1977. Requirements for design, health, safety, operation and water quality are treated. A handy reference piece.

"How Much Does It Cost to Operate Your Pool?". **American School and University** (September 1977).
Kansas State University's physical plant director analyzed operating costs for their three-pool natatorium. The construction of the pool is important; good drainage and water circulation are essential. The system has automatic controls, low labor costs and a yearly budget of $39,170.

"Pool Makes Waves". **Parks and Recreation** 12 (May 1977): 46.
The Oakland County Parks and Recreation Commission in Pontiac, Michigan has built the largest municipal wave pool in the U.S., called Waterford Oaks. With a cost of $1.5 million, this wave action pool can accommodate 600 persons in the water, and another 600 on the carpeted deck. The mechanically created waves are six foot swells which are automatically sequenced through the day.

Rubinstein, Marion. "Dallas School's Loos Swimming Center". **Kendall Sport Trail** (December 1974).
The Water Safety Program of the Dallas Public Schools brought about the building of this facility and six other pools of instructional size. The article describes a pool complex that encompasses an Olympic pool and a ten meter diving tower. The article also includes illustrations of the complex and some details of the general construction of this complex.

Smith, Jackson R. "Latest Developments in Swimming Pool Design". **American School and University** 47 (June 1975).
Recent trends and future possibilities are discussed concerning the pool area and design flexibility, costs of materials for construction are all included in the article.

"Swimming Pools: AJ Handbook of Sports and Recreational Building Design". **The Architect's Journal** 166 (August 1977) 275-280.
This article gives architects complete information on building a swimming pool; specifications, background information, reasons why swimming is important, relationship between the school and community.

THE PHYSICAL EDUCATION COMPLEX

"A Junior High That's More Than A School'. **American School and University** (March 1973).
This article deals with innovations of building construction at Thomas Jefferson Junior High School and Community Center in Arlington, VA. The controlled environmental facility contains 68,000 square feet of enclosed space and is a year-round air conditioned facility with a clear spanned 30 foot ceiling. It allows for tennis, basketball, track, softball, football, and other physical activities on its synthetic floor.

"An Architectural Happening at Pacific University". **Scholastic Coach** 42 (January 1973): 12.
Pacific University's Athletic Center is a structure that, with its distinctive graphics and exciting color combinations, clearly represents the students. The facility contains three major areas plus an underground locker room complex. The main gym area houses three basketball courts while an enclosed grassy area is available for outdoor sports. Between these two equal sized areas is a smaller area for court games like handball. Further study will give an indepth look.

Becker, B.W. "The Pricing of Educational-Recreational Facilities, An Administrative Dilemma". **Journal of Leisure Research** 7 (1975): 86-94.
The paper is an excellent economic analysis of financial problems of educational-recreational facilities. Impact of user fees, indentification of economic variables are discussed.

Browne, Robert L. "Multipurpose Facilities: More Use Per Inch, Per Hour, Per Student". **American School and University** 47 (November 1974): 23-27.
The author maintains that gymnasiums of the future should be built to accommodate many activities, many people, and maximum hourly/daily/yearly usage. The design of such facilities should follow the guidelines of efficiency, flexibility and expansion allowance. Playing surfaces, improved retractable seating, creative dimensional designs and improved structural design contribute to the goals initially stated.

Buikema, Kent A. "Centennial Educational Park". **Journal of Physical Education and Recreation** 47 (September 1976).
In constructing four high schools, all within walking distance of each other, and each with its own unique and specialized facilities, Plymouth, Michigan is well on its way to a 305 acre facility by 1980. This article is a realistic look at the stages of development of the multipurpose facilities.

"Building Without Walls". **Parks and Recreation** 10 (1975): 29-30.
A school system's new, low cost buildings are described. Most noteworthy is the pavillion, a wall-less structure used for a gymnasium and many other school activities. Costs are greatly reduced.

Coates, Edward. **"Modular Design for Activity Spaces in Physical Education-Intramural Complex". JOPER** 46 (April 1975): 30.
This article describes recommended size of modules for buildings to be used for physical education and intramural purposes. Several sketches dealing with court layouts, combination of modules and placement of modules are shown.

Dittus, Loren. "A Trip Through Unusual Physical Education Facilities'. **JOPER** Volume 49, Number 4, pp. 22-23.
This article looks at several outstanding facilities in various locations.

Dyment, Robert G. "Why Not Include Recreational Facilities At Your Office Complex". **Recreation Management** 18 (October 1975).
This article discusses the physical education complex in the private sector of business. Facilities in large corporations such as General Foods and Goodyear are discussed as to their physical makeup and about the benefits they provide.

Eddy, J. Robert. "Brookline's New Physical Education Building". **Scholastic Coach** 39 (January 1970). 18.
Brookline, Massachusetts solved a space and land costs problem by designing a four story physical education complex. The first level houses a handball court, dance gym, wrestling and weight rooms, lockers and showers. The next two levels have two full sized gyms while the top level is a simulated outdoor area with a uniturf flooring.

Eriksen, Finn B. "Planning the New Physical Education Center". **Scholastic Coach** 44 (January 1973): 74.
A sketch of the floor plan of the new physical education plant in the Central High School of Waterloo, Iowa is provided. The article also lists the sizes and purposes of the various rooms.

Flynn, Richard B. "Focus on Facilities in Public Schools". **Journal of Physical Education and Recreation** 47 (September 1976).
This article deals with the facilities of a low budget playground and multipurpose high school which share playing field activity areas and other facilities.

"Frank Kennedy Physical Education Center". **CAHPER Journel** 40 (February 1974): 27.
The feature of this article is a physical education center which was named after the late Dr. Frank Kennedy. This center has a wide range of facilities, which is composed of 163,000 square feet of space. The building is used by the University of Toronto as an athletic and educational building.

Gallagher, James D. "Big Building in Small Easy Stages. **Journal of Physical Education and Recreation** 47 (April 1976): 26-27.
This article examines the phased development concept of building in terms of durability and aesthetics, motivation and flexibility. It also offers an example of a phased development complex, complete with diagrams.

Gonino, Vince. "Cortland State College's 100 Per Cent Center". **Scholastic Coach** 46 (January 1977): 24-28.
This article describes the facilities in the three levels of the new Physical Education-Recreation Center at State University College at Cortland, New York. A description of size (square footage), spectator capacity, and activities provided for in each area is given.

Gordon, Barclay F., and Hoyt, Charles K. "Building for Sport". **Architectural Record** (February 1977): 115-130.
This article shows many new sports facilities, including pictures and floor plans.

"Go West, Young Gym Designer". **Scholastic Coach** 42 (January 1973): 11.
The new West H.S. in Wauwatosa, Wisconsin, in addition to all its other facilities, has a splendid physical education complex. This complex consists of three gymnasiums which may be divided into halves, a swimming pool, a diving pool, locker rooms, and staff offices. By having such a well planned facility, students may participate in many varied activities in this new study hall modular school system.

Hill, Frederick. "Physical Education Facilities for Senior Citizens". **American School and University** 48 (December 1975).
The author shares ideas that were implanted in three new community centers to facilitate senior citizen's needs. The area's usefulness was so evident that PTA's, scouts, faculty clubs and many others made the rooms a mecca in constant use.

Hodges, Patrick B. "Unlimited Facilities On A Limited Budget". **Journal of Physical Education and Recreation.** 47 (April 1976).
A school's physical education complex that is really the entire community's is the topic of this article. This is the story of the use by J. Sargent Reynolds CC of already existing community facilities/parks, recreational fields, playgrounds, bowling alleys, golf courses and others.

Jensen, Clayne. "An Activity Center For Both Athletic Events and Cultural Events". **Journal of Physical Education and Recreation** (April 1975): 28-29.
This article deals with the design and use of the Marriott Activity Center at the Brigham Young University campus. This is the largest facility of its kind on any university campus in the world.

Keller, F.J. "Making The Most Of Your Old Facilities'. **JOPER** 42 (June 1971): 28.
Mr. Keller attacks two problems; restoration of facilities and scheduling facilities. The author cites examples of restoration in ceiling, flooring, pools, and other areas as money saving and sensible.

Marlin, William. "The Growing of Grids". **Architectural Record** (April 1977): 107-112.
This article displays and discusses the Fumihiko Maki Central Building at Japan's Tsukuba University, which houses both the fine arts and physical education departments.

McCoy, William. "School-Community Rec Center". **Scholastic Coach** 39 (January 1970): 14.
Westchester County, N.Y. has a new facility to complement the recently completed middle school, which is also designed to be used by the community. Facilities include a 10,000 square foot gymnasium, and a 110 by 175 foot indoor-outdoor swimming pool, which has a fabric convertible roof.

"Modernistic High School Sports Complex". **Scholastic Coach** 41 (January 1972): 12, 13, 87.
This article describes the new sports complex just built in Ralson, Neb. for $18.40/square foot. It explains the reasons behind the horseshoe shaped complex. The complex includes three basketball court floors, 3,000 folding seats, a 75 foot pool, another station 35 by 108, four locker areas, laundry room, capacity of 500 for seating in the pool area, coaches conference room, storage rooms and training rooms.

Moriarty, R.J. "PERT Planning For Physical Education Facilities". **CAHPER Journal** (August 1973): 33-36.
This article outlines Program Evaluation Review Technique as an effective method for initiating and maintaining structure in order to achieve completion of a complex program demanding maintenance of cooperative effort such as those needed in facilities planning.

National Conference on Areas and Facilities for HPER. "Physical Education Facilities". **HPER** 1965.
Guidelines for sound programs and use of physical education facilities.

Olsen, Garth R. "Creative Guidelines for Using Multipurpose Sports Facilities". **Journal of Physical Education and Recreation** (April 1975): 33-34.
This article states suggested guidelines to follow and various aspects to think about when the demand for facilities becomes quite large. These guidelines include control, scheduling, priorities of use, and maintenance.

Penman, Kenneth. **Planning Physical Education and Athletic Facilities In Schools.** 1977, John Wiley and Sons, Inc.
Places great emphasis on the beginning plans.

"Physical Education Center Built 'Underground' " **American School and University** 15 (March 1975).
Detailed description of Columbia University's new athletic facility; 110,000 square feet of space with a great deal of it underground in an attempt to preserve the aesthetics of the existing land.

"Pre-Engineering Buys More Sports For Less Cash". **American School and University** 48 (August 1976).
This article concerns a design/build contractor who combined conventional methods and materials with a pre-engineered system to build the Dayton University Physical Activities Center for just $23/square foot.

Scott, Harry A. and Richard B. Westkaemper. **From Program to Facilities in Physical Education,** Harper and Brothers, N.Y. 1958.
Provides an overall view and beginning steps to physical education facility planning.

Stillman, John. "The Sports Hall: One Problem With Many Solutions" **Education,** Volume 126, June 1978, pp. 477-480.
Tells of the development of sports halls as an integral part of the British Educational System.

Thomas, Nancy and Robbins, Leslie. "An Elementary School Physi-

cal Education Complex" **Journal of Physical Education and Recreation** 47 (September 1976).
This article gives a verbal description of the facilities that are located in and adjacent to an elementary school in Ocala, Florida. They list curricular philosophy and offerings that were a guide to construction of this facility.

"Xaverian Sports/Arts Centre". **The Architects Journal** 165 (February 1977).
The new sports/arts centre at Xaverian College outside of Manchester allows both of its title components to coexist efficiently, effectively, and progressively in one complex. A brief explanation of philosophy, construction and design are included.

PLANNING FOR DUAL USE

Boycheff, Kooman. "Trends in Planning of Rec-Sports Facilities". **NIRSA** Volume 1, Number 1, 1977.
Discusses trends in developing more adequate facilities in recreation and intramurals in universities.

"Building For Changing Functions". **American School and University** 48 (June 1976): 50-51.
Indiana University is planning extensive expansion over the next 10 years and buildings will only be built as they are needed. Meanwhile, a building is undergoing construction which will be able to satisfy the present needs of the university; it will feature a student union and library.

Callington, Brian. "Implications of Dual-Use Facilities for Teachers of Physical Education". **British Journal of Physical Education** 5 (September-October 1974): 87.
This article discusses the dual use of sports facilities by physical education classes as well as the community. It emphasizes the relationships of objectives and needs of the student in reference to the facilities and educational program implemented for him.

Carlson, Jerry. "Sharing Facilities". **JOPER,** June 1978, pp. 34-36.
Contains information concerning the sharing of facilities by three agencies.

Cox, Jim. "Activity Complex". **JOPER,** June 1978, pp. 41-42.
Contains information about a multi-sport community college facility.

Dyer, Timothy. "School and Community: A New Partnership for Wayne-Westland". **CEFP,** September-October 1978.
Discusses the cooperation utilized when facilities are jointly used.

Educational Facilities Laboratories. "Physical Recreation Facilities" Educational Laboratories, Inc. 1973.
Discussed the different forms and uses of today's recreational facilities.

Gilbert, Thomas L. "Success Stories in Multiple Use" **Parks and Recreation** 12, (February 1977).
Section 201 of the Federal Water Pollution Control Act Amendments of 1972 authorizes grants-in-aid for construction of facilities which combine open space and recreational access to our waters with waste water treatment facilities and sewers by cities, town, and sewer districts. Examples of many such facilities are given.

Gonino, Vince and Thomas Steele. "Multipurpose Facility. **JOP** , Volume 48, Number 9, 1977, pp. 35-37.
Describes the guidelines and planning process utilized by Cortland when the 100 acre Physical Education and Recreation Center was built.

"High School Built For The Community". **American School and University** 48 (May 1976): 94-96.
This article deals with the use of the school for the total community. The school design is open and adaptable to a wide variety of community educational programs and activities. Over 100 different organizations make use of the school.

Jensen, Clayne. "An Activity Center For Both Athletic Events and Cultural Events". **JOPER** 46 (April 1975): 28.
This article describes the Marriott Activity Center at Brigham Young University, designed to accommodate cultural, as well as athletic events. The facility is used several times a week for athletic contests, student assemblies, and cultural events.

McIntyre, James P. "Recreation Facility Fills the Bill for Boston College". **College Movement** 9 (August-September 1974): 40-41.
Boston College's multipurpose facility and how it has positively affected the school and community is discussed. Also included are problems of meeting construction costs and annual operating costs.

Physical Recreation Facilities; A Report From Educational Laboratories. Educational Facilities Laboratories, Inc. Wintry Press Ltd., New York 1973.
A report that focuses upon the flexibility available for competitive programs, education curriculum and recreation through comparative usage of innovative and alternative facilities. The areas covered pictorially and by discussion are updating old places, techniques for new places, shared facilities and low cost-per-use facilities.

"Raising the Rooftops Consciencness". **Parks and Recreation** 12 (April 1977).
With space becoming a problem in America's cities, both public and private sectors are beginning to realize the value of rooftops as living space. Care must be taken in planning of such facilities to insure safety of people and the building. Such planning not only enhances the beauty of the property, but also increases the value of the property.

Schaake, Larry D. "Balance-Variety". **JOPER,** June 1978, pp. 46-47.
An article concerning the multi-use and multi-sport facility at Southern Illinois.

"Sharing The Show". **American School and University,** April 1977, pp. 24-25.
Contains information on the feasibility of community and school use of the same facility.

Smith, Vern. "Recipe For A Major College Multi-Use Athletic Facility" **Athletic Administration** 12 (Spring 1977).
The University of Toledo built a new $7.25 million multipurpose athletic facility which can seat 9000 people. This article explains the many uses of the building and how the facility was constructed to get maximum use.

"Sports Facility For Upstate New York." **Architectural Record** (March 1975): 121-126.
A sports facility at Potsdam, New York that is used and enjoyed by community groups and intramural student programs, as well as by varsity teams, includes a gymnasium, swimming pool, ice rink, track and exercise area.

"Sport Facilities: The New Breed" Phi Delta Kappa 56 (November 1975): 24-26, 28,
Sports facilities of the future must meet needs not only of the school population, but of the surrounding community. To accomplish this, schools and communities must work together to keep costs down; some ideas are given to this end.

Tenoschok, Michael. "After Hours Community School Programs" **JOPER,** Volume 48, Number 9, 1977, p. 38.
Gives suggestions to the use of the school for community recreation programs after school hours.

Watkins, William, "Administrative Guidelines for Community Use of Physcial Education and Recreation Facilities" **JOPER,** Volume 49, Number 9, 1978, p. 32.
Guidelines for the construction and use of facilities.

Woods, John. "New Dimensions". **JOPER,** (June 1978, p. 37.
Discloses a new seating design with spectators in mind as well as dual use as an audiovisual classroom.

Woodruff, Alan P. "Movable Walls Do Not A Flexible Building Make" **American School and University,** 48 (May 1976): 37-39.
The author discusses flexibility; what it has meant in the past and what it must mean in the future. He outlines a planning procedure (space consumption and configuration planning) to determine how much flexible space is needed in any given school.

OUTDOOR FACILITIES

ATHLETIC FIELDS

Bureau of Outdoor Recreation. **Outdoor Recreation Space Standards,** United States Government Printing Office, Washington D.C., 1967.

Daniel, W.H., Robey, Melvin, and Freeborg, Ray. "Rootzone Systems for Natural Turf." **Scholastic Coach** XL (January 1975): 24.
This article contrasts construction of four types of natural turf for athletic fields which cut down on climatic problems; prescription athletic turf, the sand bed method, adding sand to soil, and the natural soil.

Delameter, James. **Design of Outdoor Physical Education Facilities for School and Community,** Columbia University, N.Y. 1963.

Departments of Army, Navy, Air Force, **Planning and Design of**

Outdoor Sports Facilities, United States Government Printing Office, Washington, D.C. 1967.

"Football Fields Need Year-Round Care." **Cramer — The First Aider** 44 (April 1975): 8.
Discusses care of the football field (Grass) used by the band, teams, and physical education classes. Also deals with the ultimate grass field known as PAT (prescription athletic turf) now in use at Purdue University.

Gardner, John C. "Tender Loving Care For Athletic Fields." **American School and University,** (June 1977).
Lists a schedule to follow for in-season and out-of-season maintenance of your football field. Discusses liming, watering, mowing and clipping, aerifying and marking the field.

"Real Turf Fields Staging A Comeback."**The Athletic Journal** LV (January 1976): 44.
Hi-Play Systems of Portland, Oregon, developed in 1968, has designed a football field of real grass which is grown without soil. The grass is grown from seed and fed artificially. Water drains directly into drain pipes. In this article, Hi-Play cites its advantages over artificial turf.

Roberts, J.M. **Sports Facilities** American Society of Landspace Architects Foundation, McLean, Va. 1974.

Robey, Melvin J. "Real Grass Athletic Fields." **JOPER** XLVI p. 27.
Mr. Robey describes prescription athletic turf as an alternative to artificial turf, giving pertinent information about PAT in this article.

Robey, Melvin J. and Daniel, William H. "Maintenance of Athletic Fields." **Athletic Journal** 51 (April 1971): 68-70, 81-82.
The superintendent of Athletic Facilities at Purdue together with a Ph.D. in Agronomy tell how to maintain the turf of athletic fields. They advocate the use of known agronomic principles concerning selection of adapted grasses, fertilization, and watering along with manicuring procedures of aerification, top-dressing, pesticide application, overseeding, drainage improvement, plugging and rolling.

Thomas, Roger, "The Greening of a Ball Field." **Parks and Recreation** (July 1977): 54-55.
This article presents a well planned step-by-step program for proper turf renovation for athletic fields. It describes the steps taken to restore the Horlick Athletic Field in Racine, Wisconsin.

Watson, James R. "Coping With a Water Shortage." **Parks and Recreation** (July 1977): 54-55.
A leading argonomist presents an 8 point program designed to help the facility manager preserve a green healthy turf during times of forced water conservation in the hot summer months.

CAMPING

Armstrong, Robert J. "Camping Maintenance Is a Year-Round Job." **Camping** 47 (May 1975): 14.
Preventive and year-round maintenance appear to be the key cures to camp deterioration, vandalism, decreased camp appeal, and wasted monies. Contrary to public belief, camp equipment does *not* last forever. This is a real eye-opener for the camp-oriented.

Elson, M. "An Economical Way To Rebuild Our Camp Dining Hall." **Camping Magazine** 45 (1973): 41-42.
The author describes a dining hall that was pre-engineered to save money. Companion materials and labor were supplied locally. The building was built rapidly and designed so that future expansion would be easily possible.

Joseph, L. "Designing A Camp Kitchen With A Future In Mind." **Camping Magazine** 45 (1975): 18, 26.
This article explains considerations to be made in planning a camp kitchen to maximize efficiency and minimize costs.

Sanborn, R. "Year Round Usage of Camp Facilities." **Camping Magazine** 45 (1973): 8, 10.
A panel of camp directors from across the country explain how they use their camps throughout the year.

GOLF

Cornish, Geoffrey, "Golf At The Town Dump." **Parks and Recreation** (May 1977). 28-29.
This article deals with conversion of a town dump to a golf course and irrigation of the course with treated sewage. Examples are given from around the country.

Fream, Ronald. "Bringing Golf Links Up To Par." **Parks and Recreation** (December 1976).
This article deals with the importance of long range planning and use of expert consultations. Includes list of some areas in which golf courses could be improved, both visibly and playing-wise.

Fream, Ronald. "Tee Off With Creative Planning." **Parks and Recreation** X (August 1975): 20.
This article shows need for public municipal golf courses. It discusses areas of concern when building a golf course such as site selection, design, construction costs, plans and specifications, operational costs, and a possible way for continuing revenue to pay off mortgage and maintenance.

Greben, Seymour. "The St. Andrews of Frisbee Golf." **Parks and Recreation** 1 (October 1976): 22-23.
Frisbee golf is becoming popular throughout America today with an appeal to people of all ages. The author cites the Los Angeles County example and tells of the logistics in planning, constructing and operating such a course.

"The Hole Is The Goal." **Parks and Recreation** 10 (May 1975): 37.
This article reports that there are 3 basic styles of golf holes, and architects should design new courses utilizing all 3 styles in order to offer the golfer the most fair test of this skills.

Wagnew, R. and Walter, F. "Three Buildings By Clovis Heimsath." **Architectural Record** CLVIII (September 1975): 101-107.
Designs for a church, school library, and public golf course are discussed, analyzed and illustrated. Designs reflect Heimsath's belief that, "A building . . . must grow out of the best thinking we can manage about how people will use and understand and be moved by a building."

"What To Look For At A Golf Meeting Site." **Recreation Management** (December 1972): 48.
This article provides a checklist on how to select a golf site for business meetings. It explains what to look for in the course, clubhouse, staff and so on.

OUTDOOR TENNIS

Gnaedinger, John P. "Subsoil: The Tennis Court Foundation." **Tennis Industry** 4 (February 1976).
This article discusses different types of soils and their effects on a tennis court. The author also discusses ways to avoid or minimize problems.

"How To Design And Build Reinforced Concrete Tennis Courts." **Concrete Construction** 22 (June 1977).
This article deals with various aspects of court construction, such as site selection, drainage, layout, concreting procedures and finishing. It also cites some possible problems to be aware of.

Jares, Joe. "Another Put-Up Job, The Portable Tennis Courts Go Wherever You Go." **Sports Illustrated** 45 (August 1976).
A new invention in tennis is called "Port-a-Court." At a price of $1,500 it can be bought and transported from roof top to parking lot and stored in an area of only 40 cubic feet.

"Paddle Tennis: Holding Court On Today's College Campuses." **American School and University** 48 (June 1976).
The increasing interest in paddle tennis means new methods of construction, materials and motivations, as discussed in this article.

"What's The Big Idea." **Scholastic Coach** 42 (January 1973): 14.
Description of recent innovations in athletic facilities and equipment such as "Court Cover for tennis.

Whalen, Joe. "Construction Today." **Tennis Industry** 1(March 1973): 6.
This article makes some suggestions that should be helpful if one is planning a multi-court tennis facility. The things to be considered include number of courts planned, type of membership, projected percentage of young players, surfaces, clientele, type of terrain.

Whalen, Joe. "Construction Today." **Tennis Industry** 1 (May 1973): 5.
There are many items to be considered when choosing the type of surface for a tennis facility. These include the players' choice, budget available, maintenance available, court supervision, climate and whether courts are indoors or outdoors.

LANDSCAPING

American Society of Landscape Architects. **Handbook of Landscape Architectural Construction,** American Society Landscape Architects Foundation, McLean Va. 1975.

Christiansen, M. I. **Park Planning Handbook.** John Wiley and Son, N.Y. 1977.

PARKS AND RECREATION

"An Urban Alternative: Making Do With Volunteers." **Parks and Recreation** 12 (March 1977).

This article discusses how, in many large cities, volunteer groups have taken it upon themselves to construct and monitor urban recreation facilities.

Arthur, Gary. "The Ocean Bowl Story." **Parks and Recreation** II (December 1976): 14-17.
The Ocean City, Maryland recreation department has developed facilities for skateboards including ramps, bowls, and valleys made of asphalt to provide a recreation area for skateboard enthusiasts.

Behrend, Cathie. "Recreation At Your Doorstep."**Parks and Recreation** I2 (June 1977): 54.
The City of New York has taken recreation to the people; they use a mobile recreation unit which can be attached to a truck and hauled to various parts of the city. Some of these mobile units include a boxing mobile, sportmobile and swimmobile.

Brown, James. "A Million Dollars Worth of Growth." **Parks and Recreation** II (June 1976).
This article details growth of the Dalton, Ga. park and recreation system. Many of the reasons for success are pointed out.

Buerkel, Nancy L. "Construction Crew Earns School and Community Credit." **Parks and Recreation** II (May 1976): 30-31.
Buerkel reports on the construction of a recreation facility in Pontiac, Michigan utilizing workers who are 15 to 18 year old students in the high school's vocational programs.

Buikema, Kent. "Centennial Educational Park." **JOPER** (September 1976): 20-21.
This article deals with four comprehensive high schools on one site and the facilities that are built on that site. Indicates how the specialized facilities are shared within the school district.

"Building For Sports." **Architectural Record** 161 (February 1977): 115-130.
This building type study includes sections on the Uptown Racquet Club in New York, a National Park Service Stable in Washington, D.C., the Hampden Country Club in Hampden, N.J., and The Marin Tennis Club in San Raphael, Calif.

Bureau of Outdoor Recreation. "State and Local Recreation Roundups." **Outdoor Recreation Action** 40 (Summer 1976).
Due to the celebration of the bicentennial, many communities throughout the U.S. established recreation programs and opened many outdoor areas for recreational purposes. This article lists samples of these projects according to state and provides a small synopsis of each of the undertakings.

Cantwell, Robert. "Oh, Can't You Hear The Whistle Blowing". **Sports Illustrated** (August 1976): 24-26.
Converting old railroad lines into usable recreational areas is the new idea passed by Congress at a tune of $20 million. Across the U.S., states are renovating lines into nature trails, hiking paths and cyclist trails. This recreational innovation is "simple, cheap, and practical."

Corrado, Paul, "Designing Playgrounds for Multifamily Dwellings." **Parks and Recreation.** Volume 14, Number 2.
Gives construction guidelines for developing play areas in housing developments.

Cross, Gertrude. "The New Leisure Class: Gray But Not Blue." **Parks and REcreation** 12 (June 1977): 32-35.
Cross points out the necessity of recreation for people ranging in age from 50 to over 90 years and makes suggestions on how to achieve this goal.

Flynn, Richard B. "Community Recreation Facilities." **JOPER** Volume 48, Number 8, 1977, p. 33.
Contains information on the construction of a community center for multi-use by a variety of agencies.

Gold Seymour M. "The Fate of Urban Parks." **Parks and Recreation** (October 1976).
The author mentions problems urban parks are facing, and lists suggestions for changes on both local and regional levels. He stresses that parks must make changes to meet the changing needs for today's society.

Graves, Charles M. "Siting Sports Facilities." **Parks and Recreation** (August 1976): 21-22.
This article describes the procedure to use to place softball fields, football fields, tennis courts and swimming pools so that the players are not looking into the direct rays of the sun. Includes diagrams.

Hulvershorn, J. Kip. "Recreation Complexes." **JOPER,** Volume 48, Number 9, pp. 45-47.
Major emphasis of this article is on the construction of outdoor facilities in conjunction with new indoor facilities.

Kennedy, Ray. "Miracle In The Meadows." **Sports Illustrated** (September 12, 1977).
The article discusses the construction of the Meadowlands Sports Complex including financing, promotion and public relations. The article is beneficial for those planning a major sports complex since it describes many of the problems that will be encountered.

Little, Rufus. "Project Adventure." **JOPER ,** 47 (June 1977): 13-16.
This article describes how project adventure brings Outward Bound type of experiences to regular physical education classes, using trees, open fields, empty lots, buildings or whatever else is available near the school.

"Programs Are For People." **Parks and Recreation** 12 (June 1977).
This article deals with the struggle between conservationists and recreation programmers in terms of utilization of parks and recreation areas; conservationists fighting to keep parks in a natural state, and programmers fighting to change parks to meet the needs of the people.

Rentz, Noel. "Community Service Program Nets New Recreation Facilities." **Recreation Management,** November 1977.
Deals with a work study program which employed local youths to build a recreation facility.

Robbins, Guy E. "Build Bike Paths To Last." **American City and County Magazine** (April 1977): 70.
Concrete construction of bikeways is encouraged for durability and economy. Subgrade preparation, mix design, placing, finishing, crack control and curing are covered.

Wilder, Robert. "EEI: A Survival Tool." **Parks and Recreation** 12 (August 1977): 22-24.
It has become necessary for park and recreation departments to justify quantitatively their needs for more recreation facilities. To do this on the basis of a social cost-benefit analysis, it became necessary to devise the economic equivalency index. This index states the social value of a recreation center into dollar terms.

Young, Eugene. "Interstate Land For Municipal Parks." **Parks and Recreation** (April 1977): 37-38.
The East Baton Rouge Recreation Department has obtained a 40 acre tract of grassy land beneath an interstate highway for construction of a new park. Known as Expressway Park, it contains everything from picnic facilities to bike paths. They have begun development on the other side of the expressway "to enhance" the beauty of the expressway, but most importantly, to provide multiple use by the public.

SCHOOL PLAYGROUNDS

Bledsoe, Audrey, "Playscapes, Sculpture-Playground in Atlanta." **School Arts** 76 (April 1977): 22-25.
A playground in Atlanta has sculptured equipment instead of stainless steel and cast iron. The equipment shown is very functional and aesthetic.

Broekhoff, Marna. "A Playground To Stretch The Imagination." **JOPER,** (October 1978): pp. 27-28.
Deals with the planning and construction of an unique playground.

Burke, J.E. "How To Buy Playground Equipment." **American School Journal** CLXII (February 1975).
This article discusses various types of equipment including surfacing, sliding boards, climbing apparatus, swings and much more. Safety, durability and cost of each piece of apparatus is also mentioned.

"Color-Coated Playgrounds." **American School and University** (June 1976).
Shelter Rock Elementary School in Manhassett, N.Y. recently recoated the playground and basketball court with colored materials. This was done at low cost by the custodians and produced more activity by the children and easier supervision.

"Everyone Can Play." **Nation's Schools** 2 (February 1975).
This article tells how Madison School in Sheboygan, Wisconsin, built an adventure playground that would accommodate normal and handicapped children.

Friedberg, Paul M. "Taking Play Seriously: The Experimental Playground." **American School and University** (June 1976).
An interview in which Friedberg discusses the basic concepts underlying the need for and development of a playground to encourage experimental play by young children. Numerous photographs illustrate the ideas discussed. The discussion centered on Friedberg's book, **Handicrafted Playgrounds: Designs You Can Build Yourself.**

Haher, John. "A Recycled Playground." **JOPER** 46 (January 1977).
An elementary PTA used discarded business and industrial materials to build an inexpensive but useful playground. A brief discussion on what materials were gathered and how they were distributed follows.

Johnson, Ronald. "Differences In Choice Of Areas For Recreation." **CAHPER,** July-August, 1978, pp. 50-55.
Contains data for the development of playgrounds.

Kidder, Worden, "A Rebuilt Playground." **JOPER** 47 (September 1976).
This article describes the rehabilitation of a playground in Minneapolis, Minn. Parents built the playground for $6,300 and contractor now put its worth at over $100,000.

Licht, Kenneth. "Safe Playground Design." **American School and University** 47 (December 1974): 23.
An excellent article on playground design with an emphasis on safety. The article deals with site selection, surfaces, matting, apparatus, and objectives of the playground. "The playground should have challenges while minimizing danger."

Moore, Jane, B., Bond, Aletha W., and Cobb, Jane. "An Experience Center for Elementary Physical Education." **JOPER** XLVI (January 1975): 21.
This article advocates doing away with playgrounds in the traditional sense so that an atmosphere more conducive to development of motor skills by movement exploration may be built. Sketches of the author's views are given.

National Recreation and Parks Association Research Team. "Play Streets." **Journal of Leisure Research** VII (1975).
This article examines some of the recent attempts to provide play streets in New York. Under such a scheme, pedestrian and vehicular traffic are separated. Mention is made of mobile recreation vans bringing facilities to the users.

Pattner, Richard, "Playgrounds Aren't For Playing: Playgrounds Are For Growing And Learning." **The American School Board Journal.**
Espouses the belief that a playground is as important as a schoolhouse and should be accorded comparable concern and consideration during its design and construction.

"Playgrounds From Junkyards." **American School and University** 44 (August 1972): 22-23.
A short article on innovative possibilities for playground equipment. Several before not-thought-of ideas are expressed with an address to write for more information.

Rutledge, Arthur J. "Playground Design With A Motive In Mind." **Parks and Recreation** 0 (February 1975): 20.
This article describes in general terms, a playground design which fits a theory of play developed by Michael Ellis. It lists the advantages of this new playground against the traditional and adventure type playgrounds.

Staffo, Donald. "Children's Play Area." **JOPER,** Volume 48, Number 9, p. 39.
Concerns the construction of playground with volunteer help and materials.

Suter, Antoinette B. "A Playground—Why Not Let The Children Create It?" **Young Children** 32 (March 1977): 19-24.
This article presents ideas for construction of play areas for children, by children, with movable equipment. Types of materials that can be used are suggested, safety precautions listed and rules to be used.

Thompson, Donna. "Space Utilization: Criteria For The Selection of Playground Equipment For Children." **Research Quarterly** 47 (October 1976).
By studying the different ways a child moves it is possible to choose equipment to enhance these movements. Equipment can be related on the basis of its contributrion to education of a child within a curricular framework and not just for recreational value.

Wallach, Francis. "Keep The Dragon Off Your Playground." **American School and University.** (January 1978): Volume 50, Number 5, pp. 26-28.
Contains information about the Consumer Products Safety Commission and their recommendations for safe playground equipment.

Wallach, Francis. "Mobile Playgrounds Save Money." **American School and University.** 45 (April 1973).
This article shows savings due to mobile facilities which enrich existing activities as well as provide services to otherwise neglected areas.

Webb, James L. "Vita Parcours, American Style." **JOPER** XLVI (October 1975): 24.
This article deals with a new idea from Switzerland which combines jogging trails and exercise stations. The basic Swiss idea is applied to American ideas, but altered somewhat. Such a course is described and planning is discussed, illustrating types of equipment and materials used for their construction.

SKATING RINKS

"Arena Components." **Hockey and Arena Biz** 5 (February 1977).
New developments are discussed including the turnkey concept, plastic ice surfaces, lighting and energy considerations.

"Basic Steps In Planning and Building An Ice Rink." **A Trade and Sport Publication** U.S. Hockey B 12, Volume 1 (October 1973).
This guide is four articles from the magazines **Rink** and **Arena** and include:
Part I — the advance work. This is selection of the location and type of rink.
Part II — rink construction and operation.
Part III — bids and how to handle them.
Part IV — management.
The articles stress the use of experts and experienced people for guidance

"Government Funding For Ice Facilities." **Hockey and Arena Biz** 4 (December 1976).
Here is an outline for funding ice facilities from the Federal Government through provisions in the Land and Water Conversation Fund and the Public Works Act.

"How a Small City Plans and Constructs a Multipurpose Area." **Hockey and Arena Biz** 4 (September 1976).
A step by step account of financing and planning a multipurpose ice facility with special regard to community acceptance and level-headed leadership.

"The Systems Approach To Skating Rinks." L.T.P. Enterprises, 1973.
L.T.P. Enterprises has a system for building ice rinks which seems to be very economical and efficient. They have the four systems of structure, rink boards, refrigeration, and maintenance and management.

SKI AREAS

Balosky, Patricia. "Introduction to Skiing On Dry Land." **JOPER** 43 (January 1972): 62.
A dry land skiing unit has been taught for several years in a California high school. Its main purpose is to expose students to fundamentals of skiing in areas where snow is not available but ski areas are accessible.

Branch, James, and Rowan, David. "Developing An Urban Ski Facility." **Parks and Recreation** 10 (September 1975): 21, 52.
This article provides a detailed account of ski resort development focusing on terrain, climate, and temperature. Co-authored by the president of the Association of Ski Area Consultants, it provides excellent aspects of skiing according to public demands

Johnson, H.C. "Landfills to Ski Hills." **Parks and Recreation** (May 1976).
Solid waste disposal is a major problem to most cities but in a suburban Chicago area several city landfills are being converted into public recreation facilities. Hilly areas are being turned into ski slopes and master plans call for sled and toboggan runs.

Zingdale, Donald P. "A Skiing Facility For The College Physical Education Program." **The Physical Educator** 29 (March 1972): 3-5.
With today's college student turning more and more to skiing as a leisure time activity, this Ohio State author outlines a program suited for adaptation to any university or college situation. Special attention is given to available terrain, type of snow, recently developed surfaces, ski tows, and lighting for night skkiing.

SWIMMING POOLS

"A Safer Splash." **American School and University** Volume 49, pp. 26-27.
Contains information on a pool renovation.

"A Swimming Pool Gets Second Life." **Parks and Recreation** 6 (May 1971).
When the Greensburg, Pa. YMCA decided to build a new Olympic size pool they didn't want to lose the use of their old

pool, so a new aluminum liner was added to the old pool. This brought it to a depth of 42 inches and it is now used as a training pool.

Bonebrake, Case. "How Much Does It Cost to Operate Your Pool." **American School and University 1 Volume 50, Number 1, p. 44.**
Provides information about operating costs of pools.

Capulli, Angelo. "Cutting Costs With An Automated Swimming Pool." American School and University 48 (June 1976).
This article explains how automated control of swimming pool chemical balance has saved an Illinois school and park district more than $5,000 a year since 1972. In addition to operating completely unattended with requiring calibration for a predictable 10-20 year functional life span, the real benefit is the better quality water.

Council Nat. Coop. in Aquatics. **Swimming Pools, A Guide to Their Planning, Design and Operation.** Hoffman Publishing, Fort Lauderdale, Fla. 1972.

Gross, F.L. **Handbook of Swimming Pool Construction, Maintenance, and Sanitation.** Technomic Publishing Company, Westport, Ct. 1974.

Dawes, John. "Spatex '78." **The Times Educational Supplement** Number 3270 (February 10, 1978): pp. 35-38.
This article deals with new offerings in pool facilities.

"How To Detect and Control Pool Problems." **Recreation Management** (May 1972): 8.
This article gives advice on how to eliminate some common pool problems. It explains how to eliminate algae invasion, overcome cloudy water, and the relationship of burning eyes with chlorine content.

"Learner Pool Teaches Kindergartens to Swim." **American School and University** (August 1973): 32.
This article discusses the "Miracle Learner Pool," designed specifically for instruction rather than recreation. It allows for a charted bottom, making group control easy, uniform depth, and adjustable and heated water. It may be installed for less than $5,000 and is movable.

Levenson, S. "Swimming Pool Hazards." **Times Educational Supplement** 2943 (October 15, 1971): 51.
The author explores the hazards of incorrect chemical usage in pools. He cites a lack of experienced people in chemical usage as a main reason. The article lists many hazards and their corresponding corrective measures.

Mason, James G. "Indoor Swimming Pool." **JOPER** Volume 48, Number 9 (1977): pp. 42-43.
Contains a description of a year-round use facility.

"Pools for Schools: Great Britain." **Times Educational Supplement** 2915 (April 2, 1971): 54.
After justifying the need of a swimming pool in all schools, the author advises the correct steps in acquiring a pool. Choosing, financing, and maintaining the pool contributes to the bulk of the article. Two supplementary articles discuss reasons for an elementary and advance pool, and hydro-therapy.

"Solar Pool Blanket Reduces Energy Use." **Athletic Purchasing and Facilities** Volume 2, Number 4, p. 47.
Lists the advantages of the solar pool blanket in energy savings.

"The Pool With The Movable Bottom." **American School and University** Volume 50, Number 2, (October 1977): p. 38.
This article deals with an innovation for handicapped use of pool.

Thomas, David G. "Pool Features." **JOPER** (June 1978): pp. 42-43.
A complete description of New York University's pool facilities.

Wise, Samuel. "Getting Your Public Pool on a Paying Basis." **Parks and Recreation** Volume 13, Number 3, pp. 31-34.
Accentuates the role of careful management in relation to profits.

TRACK AND FIELD AREAS

"Air Inflatable Track Facility For Winter Use at Harvard." **American School and University** 42 (May 1970): 32.
Harvard University has a new 45,000 square foot vinyl coated nylon track facility that cost less than 10 cents per cubic foot. Manufactured by Air-Tech Industries, Clifton,N.J., it can be inflated in 15 minutes.

Dunston, Gregory, "Make Your Own Water Jump." **Scholastic Coach** XLIV (January 1974): 38.
This article gives instruction for constructing a steeplechase and the equipment that is involved. Expenses can run very high, so attempt to get private donations for as much of the equipment as possible.

"400 Meter Track." **Scholastic Coach** (August 1976).
A detailed schematic layout of a 400 meter track with proper markings for all intercollegiate track and field events.

Kahler, Robert W. "Northern Illinois' Ten-Lane Track." **Scholastic Coach** 37 (January 1968): 30.
The author describes Northern Illinois' Physical Education Plant, which is underneath the football bleachers, and the all-weather composition track with has ten lanes. The field events are held inside the track area.

Lafferty, Robert E. III. "How to Apply Metric Principles to Track Conversion." **Athletic Purchasing and Facilities,** Volume 2, Number 2, pp. 40-43.
Gives appropriate information for conversion of track to the metric system.

"Latest in Designs, Track Stadiums, and Physical Education Center." **American School and University** XLVII (October 1974).
Photographs and design concepts of the University of California track and field stadium and Merrimack College of Andover, Mass., are presented.

"Rooftop Runaround." **Parks and Recreation,** 10 (May 1975): 35.
This article reports of a YMCA in Nashville, Tenn., that has constructed an outdoor track on top of its building. The track, approximatley 18 laps to the mile, is made of Chevron's 440 Surfacing System.

"Track and Field Layouts." **American School and University** 44 (November 1971): 26.
A square track plus artificial surfacing can, in far less space, accommodate what used to be three separate areas. Converting the track to a square plus changing the measurements to the metric system are two suggestions to utilize when space and funds are at a premium.

Wilkens, Vern. "How to Buy or Build a Running Track." **Athletic Purchasing and Facilities,** Volume 2, Number 7. (December 1978).

ENVIRONMENTAL CONSIDERATIONS

ACOUSTICS

Pierman, Kenneth A., England, James S., and Steiner, Norman. "Sports and Noise: How Much Is Too Much?" **American School and University,** (March 1977).
A study was undertaken by Washington State University to evaluate the acoustics in different areas within their physical education complex. They found that all spaces, but especially the pool and racquetball courts were noisier than they should or needed to be. Each area was treated with special acoustic tiles to reduce problem noise.

COOLING AND HEATING

Farrell, Ranger. "Selecting Heating and Cooling Systems." **American School and University** 44 (January 1972): 18.
Types of current heating systems are discussed along with problems of temperature, humidity and ventilation.

"Fun Under A Sun Powered Roof." **Parks and Recreation,** Volume 13, Number 5, (1978): pp. 36-37.
Describes a solar heating and cooling system in a community recreation center.

"Infra-Red Radiant System Heats This Gym at Low Cost." **American School and University** 42 (January 1970): 57-58.
Description of infra-red heating system in large gym including many advantages as opposed to conventional central heating.

Mertz, Edwin. "Good Roofs Save Energy." **American School and University,** (July 1977).
The basic variety of problems with roofs is discussed. The author then talks about the importance of insulation and roof maintenance.

Penman, Kenneth. "How to Conserve Energy in Sports Areas." **Athletic Purchasing and Facilities,** Volume 2, Number 4, (1978): p. 26.
Provides information on energy conservation within sporting areas.

Santamaria, Joseph W. "Designing To Save Energy." **American School and University,** (April 1977).
This article focuses on the importance of close coordination between the architects and electrical engineers. The number of exterior walls is reduced for heating and cooling purposes.

"Solor Heat Makes College Possible." **American School and University** 48 (March 1976): 53-57.

Community College of Denver switched to solar heat when it became unable to obtain enough gas to heat the college's new buildings. This article briefly explains now the solor heating system works, and why organizations have waited until how to take advantage of the sun's energy.

"Solar Shield Cuts Glare and Build-Up of Heat." **School Management** 15 (March 1971): 31.
Description of louvred type awning which reduces glare and heat build-up while allowing light to pass through.

Swisher, Pat. "The Coming of Solar Heat." **Southern Living** (December 1976): 34-36.
The author lists various school systems in the southern region of the U.S., that are experimenting with the idea of solar heat. Several athletic facilities are listed as utilizing solar energy for hot water in their shower systems.

"Two Cities Get Jump on Solar Energy." **The American City and County** 92 (April 1977).
This article describes the use of a solar heating and cooling system in the Shenandoah Solar Recreation Center, Shenandoah, Ga. The system provides heating and cooling for a full gym, ice rink, meeting rooms and an exhibition theatre at a savings of $77,000 per year over conventional heating and air conditioning systems. The article also describes a similar, though smaller, system used to heat a swimming pool complex in San Diego.

LAYOUT DESIGN

"Architect's Aide: A Computer." **American School and University** 44 (November 1971): 43.
Computers can be used to aid in planning the lay-out of a school; included in the data are the number of students enrolled per day, per period, distribution, movement volume, cost and area needed.

Caudill, Bullock, and Lawyer. "Seventeen Ways to Build for an Energy-Scarce Future." **College and University Business** LVII (July 1974).
A handbook of design principles, all of them in use in educational buildings. Shows how natural and technological resources can be used in planning buildings that save energy, now and for years to come.

Coates, Edward, et al. "Focus on Facilities." **JOPER** XLVI (April 1975): 23-24.
A whole series of articles examining various aspects of facility planning areas, included are flexible utilization, community use at low cost and modular design for activity spaces. The final article discusses the creative use of multipurpose facilities.

Gallagher, James D. "Big Buildings In Small Easy Stages." **JOPER,** 47 (April 1976).
This article discusses the development of athletic facilities using a phased approach; that is, a co-ordinated, sequential and logical progression of construction projects over a period of several years. The five phases of development used for the Penn State University are shown.

Gardner, John C. "38 Ways to Avoid Trouble in New Facilities." **American School and University** XLVII (May 1975).
The most troublesome items in the design of new facilities are briefly covered by the author.

Graves, Charles M. "On Siting Sports Facilities." **Parks and Recreation** II (August 1976).
This article discusses planning and layout of athletic fields and facilities so as to avoid sun glare and to insure maximum safety.

Hill, Fredrick W. "Flexible Facilities Are A Must."**American School and University** (September 1974): 18-19.
The changing trend toward more involvement by women in sports has put more pressure on the designers and planners to accommodate the needs of women in the facility.

Kotz, Anthony. "Building a Facility? How To Find and Work With a Consultant." **Recreation Management** (November 1974): 16.
This article explains the procedures involved in working as an administrator in a facility planning project and how you must coordinate your planning with a professional consultant. It also discusses how to go about selecting a consultant and what his duties are in relation to yours.

Keene, Charles. "Using Balconies in Physical Education Programs." **JOPER** 48 (April 1977): 64.
This article describes how the directors of one physical education program at a senior high school in Piase, Ill., overcame a problem of overcrowding by utilizing balcony space in an effort to sustain their program at a level they considered adequate. Safety precautions are included, along with ideas of what activities can take place in such a limited area.

Meditch, Carl. "Physical Educators Plan Facilities." **JOPER** XLV (January 1974): 22-23.
The author stresses that physical educators should initiate and become intricately involved in planning areas and facilities for their programs. To achieve this action, a basic plan for initiating a facilities course which will help HPER students become familiar with planning processes is unveiled.

O'Donnell, Dennis H. "Physical Education Program Specifications A Must in Faculty Planning and Design." **Journal of the Canadian Association for Health, Physical Education and Recreation,** 38 (March-April 1972): 3.
In this excellent paper, the author outlines five major factors affecting physical education facilities; location, environment, equipment, behavioral patterns and group size. In addition, recommendations are made regarding building specifications, building job flow, communication devices, program specifications, research, and requirements of good program specifications.

Otott, George E. "Recreation Fitness Center: Blue Print For a Successful Operation." **Recreation Management** XLX (November 1973): 10.
This article advocates that physical educators should be involved in "good" planning. It states that space, equipment, layout, and design and operation are vital factors to be taken into consideration in the initial planning stages.

Puckett, John R. "Planning Educational Specifications For Health and Physical Education." **The Physical Educator** 30 (December 1973): 203-204.
The article deals solely with educational specifications. State that the major purpose of educational specs is to assist in planning functional and flexible facilities to house effectively the proposed program. The article also lists guidelines for writing educational specifications.

"R. Crosby Kemper Jr. Memorial Arena." **Architectural Record** 159 (March 1976): 109-114.
An architectural prospective of the Kansas City based arena. The complex's three unique supportive triangular roof trusses and its overall flexibility are outlined in this article.

Ridini, Leonard M. "Suggestions for Utilizing Limited Space Effectively and Efficiently For Large Student Enrollments." **International Journal of Physical Education** 14 (Spring Edition 1977).
This article deals with how you must coordinate use of facilities that have only temporary partitions, such as a drop curtain in a gym. It also talks of utilizing auxiliary spaces and outdoor areas to relieve some of the congestion a building might feel.

Rogers, Walter E. "Planning Aided By Inexpensive Study Models." **Camping Magazine** 49 (September-October 1976).
The author explains how a study model of a camping facility will help determine whether or not the physical facilities will support a program as originally conceived. The model is a 3-D reproduction drawn to scale including all aspects from vegetation to people.

LIGHTING

Adra, Tom "Inadequate Lighting—How to Triple Illumination and Save Money." **Athletic Purchasing and Facilities,** Volume 2, Number 2, (1978): p. 38.
The article contains information on upgrading outdoor lighting of sports facilities.

Anderson, Herbert. "Better School Lighting For Less Energy Cost." **American School and University** 49 (December 1976): 42-43.
This article is about providing the best lighting for less money by providing the correct type of lighting. Lighting needs are discussed.

Gloster, Charles D. "Indoor Tennis Lighting: The Facts and Fictions." **World Tennis** 19 (May 1972): 32.
The author offers a concise discussion of the basic needs of indoor tennis lighting and methods for meeting those needs. His best suggestion is that of providing a direct-indirect type system.

Illuminating Engineering Society, **Sports Lighting,** Illuminating Engineering Society, N.Y. (1972).

"Indirect Lighting System For New Geodesic Dome Sports Center." **College Management,** 7 (June 1972): 35-36.
This article discusses Centenary College of Louisiana which has a new geodesic domed Sports Center with a unique indirect

lighting system providing brilliant, uniform, glare-free illumination with reduced maintenance.

"Innovative Design For Gym." **America School and University** 48 (September 1976).
West Valley College in Saratoga Ca., built a new gym with natural indirect lighting. Large recessed panels around the perimeter reflect sunlight upward into the gym. This article offers alternatives to traditional lighting systems.

"Lighting For A Championship Softball Field." **The American City** 87 (October 1972): 122.
This brief article tells how York, Penn., went about securing the best lighting for their championship softball fields. An important asset of the article is a cost comparison chart of the lighting of Hoffman Field using three types of light sources; multivapor was the most economical.

"Mercury Vapor Lighting." **College Management** 7 (January 1972): 37.
The Wide-Light Corp., installed fluorescent lighting in the multipurpose gym at the University of Vermont. The lights in the facility can be brightened for basketball games or dimmed for dances or concerts.

National Electrical Contractors Association. "Balancing Lighting and Thermal Designs." **American Schoo! and University** 42 (April 1970): 29, 40.
Describes differences in heat radiated to occupants and room surfaces through incandescent and fluorescent lighting. Height of ceiling, need for reading light, and activities in room must be considered.

Oaks, Howard, A. "Lights, Lights, Lights." **Parks and Recreation** 5 (January 1970): 43.
The expanding need of outdoor recreation areas has created a need for different types of outdoor lighting. This article discusses the major types of lighting and uses of each.

Peery, Robert, and Scarborough, Jal. "Sports Lighting: Relight or Beef Up?" **Scholastic Coach** 46 (January 1977).
The authors give an in depth approach on how to evaluate your present lighting system. Also they point out factors which should be taken into consideration when determining which lighting system is right for your situation.

Product Application: "Dimmers Assist Flexibility of Multi-Use Gymnasium." **American School and University** (July 1976).
This article discusses the use of mercury vapor lights and dimming ballasts with related control equipment at a junior high school in Ill. This permitted use of the facility without adding a more expensive light system for low light levels.

Weld, Wallace. "Illuminating Ideas." **Recreation Management** (November 1975).
This article gives the history of lighting along with tables on lamp efficiency, price and longevity of today's lamps. Also discussed are common floodlight requirements for various sports.

MAINTENANCE AND REMODELING

"Add A Splash of Color." **Parks and Recreation** II (May 1976).
This short article tells of a new line of polymer color coatings called "Easy Steps." The maintenance costs are diminished and the colors add brightness to concrete or asphalt.

"Athletic Fields Renovated at Case Western Reserve University." **American School and University** 48 (December 1975).
This article tells how $500,000 was used to renovate Case Western athletic fields and gives a diagram of the facility. The University now houses the first all-weather track in Ohio, new general fields, new press boxes, basketball courts, field houses and a laser security system.

Balshone, Bruce. "Community Maintenance For City Parks." **Parks and Recreation** 12 (August 1977): 34-37.
Thirty parks in the city of Seattle have signed formal contracts with neighborhood people to be grounds keepers for their parks under the new system called "Community Contract Park Maintenance." It is this program that provides the city with low cost labor to provide maintenance.

Bronzan, Robert T. "A Practical Approach to Safety-Emergency-Maintenance." **Athletic Purchasing and Facilities.** Volume 2, Number 2, (1978): pp. 22-23.
Provides a method for institution of a safety council for the safe operation of sports sites.

Bussard, Ellen and Alan Green. "Re-Use as an Option." **Council of Educational Facility Planners Journal,** (September-October 1978).
Discusses methods of re-use of existing facilities to meet present needs.

"Four Gym Teaching Stations By Adding Dividers." **American School and University** 49 (June 1977).
This article describes how a fourth teaching station was added with the addition of an electrically operated roll-up gym divider. This type of divider was made of nylon reinforced vinyl on the lower portion and mesh on top, and can be stored above the gym.

Hampton, Clark, "Gym Floor in Perfect Condition After Eighteen Years." **School Management** 15 (May 1971): 43-44.
Describes the maintenance of a gym floor by a discing recoating program. No stripping or sanding necessary. Also gives merchandise info.

Karabetos, J. "Facilities For The 70's." **Physical Educator** 27 (December 1970): 171.
The author asserts that one of the basic faults in facility development is the lack of planning on the part of those who will use the facility. Innovative planning is the only recourse to problems such as overcrowding, new curriculum development and so on.

Keller, Roy. "Making the Most of Your Old Facilities." **JOPER** 42 (June 1971): 26-28.
This article offers many suggestions for maximum use of available facilities. The author describes the University of Illinois' space utilization office, which controls the University's physical education facilities.

"Maintenance For Outdoor Surfaces." **American School Board Journal** 162 (November 1975).
The climate in which one lives is a main determinant in choosing equipment for lawn care. Constant, but careful maintenance is needed for outdoor facilities such as playgrounds, tracks, and tennis courts to insure their life cycle.

Martin, Stanley E. et al. "Remodeling: What to Look For Before You Start." **American School and University** (January 1976).
Before remodeling and sinking money into school area facilities, impartial, comprehensive evaluation of facilities by professional teams would be wise.

"OSU Puts Sports Where the Students Are." **American School and University,** Volume 49, Number 4, (1976): pp. 32-33.
Describes the recent addition of three new recreation facilities on the campus which are located for student use.

Penman, Kenneth and Paul Harruff. "How to go About Reconditioning Racquetball Court Wall Surfaces." **Athletic Purchasing and Facilities.** Volume 1, Number 5, (1977): pp. 26-29.
Discusses the best wall surfaces and how to repair current wall problems.

"Rehabilitating Campus Buildings— Is It Worth The Effort?" **American School and University** 43 (July 1971): 30.
The value of rehabilitating a building depends on the building itself. Most old ones have definite assets, unique architecture, thick walls, few windows — which can mean a 30% saving over the cost of a new building. Several examples of rehabilitative projects are given.

"Renovation Solves A Dual Problem." **American School and University** 49 (October 1976).
A central city school was brought up to par with the city's recently constructed high schools by renovation. The project was broken into phases to allow the school to remain open during reconstruction at a savings of $8 or $9 million over a new school.

Sharman, James E. "A Flexible Education Plant Concept to provide Greater Flexibility at Minimum Cost." **JOPER** (April 1975): 25-26.
This article deals with making additions to existing buildings along with rehabilitating existing buildings. Also lists general ideas for constructing additions.

"Tender Loving Care for Athletic Fields." **American School and University,** (June 1977).
Relates necessary information for the maintenance of athletic fields.

Terizan, Turk. "Planners Face Challenges to Upgrade Existing Facilities." **Athletic Purchasing and Facilities,** Volume 1, Number 8, (1977): p. 37.
This article describes the hardships faced when trying to upgrade old facilities.

SYNTHETIC SURFACES (INDOOR)

Ashley, John A. "Protecting The Gym Floor." **Scholastic Coach** 41 (January 1972): 46.
The author speaks of the vinyl Tuff-Spun matting which Wooster College (Ohio) purchased to protect the new gym floor. The gym

is used for numerous activities and thus, had to be protected from damage.

"Back to Basics: Floor Finishes." **American School and University** 49 (January 1977).
This article points out the importance of correct floor finish to be used under the prescribed conditions. Since floor finish costs are minimal, 10% of floor maintenance costs, the proper finish should be purchased. Many floor finish types are named, and a brief discussion of their differences, advantages, and disadvantages are included.

Byrnes, John N. "Selecting The Right Gym Floor." **American School and University** 48 (April 1976): 38-41.
Many factors must be considered when choosing a gym floor, including durability, appearance, installation, maintenance, and usage, as discussed in this article.

"Fabric Roof Tops — A Permanent Structure." **American School and University,** Volume 48, Number 34, (1976).
Discusses the use of a bubble roof at minimal cost to make a permanent building.

Mittelstaedt, A.H. and Theibart, R. "Innovative Recreation Surfacings." **Scholastic Coach** 45 (January 1976): 58.
This article lists factors to be considered when emphasizing different types of surfaces to be used in a facility.

Piper, James E. "Painting Plastic Turf." **American School and University,** Volume 49, Number 7, p. 36.
Describes an economical way to paint plastic turfs.

Schmertz, Mildred. "A School for Dance by Gunnar Birkerts." **Architectural Record** (February 1977).
This article shows floor plans, special effects and many pictures of the new Dance Instructional Facility of the State University of New York.

"Synthetic Gym Floor Enhances Both Function and Design." **School Management** 15 (August 1971): 42.
A short article giving the advantages of no dead space, a sound muffler to the rest of the school, and a uniform surface to play on. The tartan floor is rated as an investment in the long run.

Synthetic Surfaces Make Fieldhouse More Functional." **Athletic Purchasing and Facilities,** Volume 2, Number 3, (1978), p. 24.
Describes some of the benefits of the "Tartan" surface.

Useful Ideas: Loyola's Soft Surface Floors Used for All Court Games." **Athletic Purchasing and Facilities,** (June 1978).
Gives information on the successful installation of the Pro-Gym soft surface floors.

SYNTHETIC SURFACES (OUTDOOR)

"Can Natural Turf Compete With Artificial?" **Athletic Journal,** 56 (April 1976).
A new type of turf has been developed by Manhattan Perennial Rygrass. The composite rye grass grows continuously throughout the year on a set type of base material.

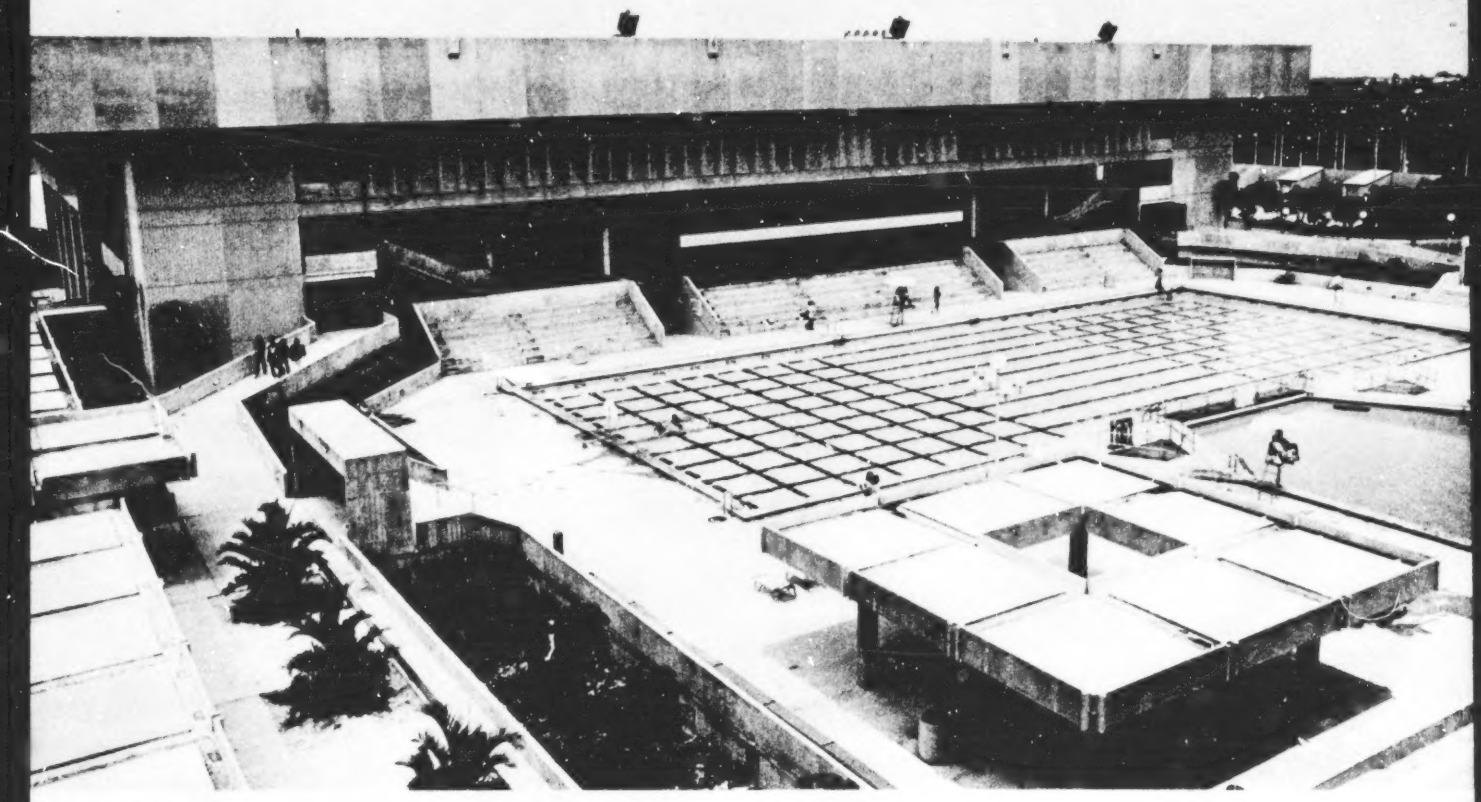
Chevrette, John M. "Artificial Turf is Faster." **Athletic Journal** (June 1977).
Test comparing speed in the 40 yard dash and Illinois Agility Run on the surfaces of natural grass, wood, and Astro-Turf showed no significant difference was found in the 40 yard dash, but there was significant difference found between each of the surfaces on the agility run, with the run faster on wood than grass, and the fastest of all on artificial turf.

Gardner, John C. "Tender Loving Care for Athletic Fields." **American School and University** 49 (June 1977).
Gardner expands on details of maintaining natural football turf. Included in the procedures are soil testing, fertilizing, irrigation, mowing, clipping, aerifying, and general clean up.

"Multipurpose Stadium Boasts Roll-Up Football Field." **American School and University** (April 1973): 79.
The world's first one piece, portable football field laid down and removed mechanically (in about one hour each way) has been installed in New Idaho Stadium at The University of Idaho, Moscow. Pertinent information is presented and uses explained.

Piper, James. "Painting Plastic Turf." **American School and University** 49 (March 1977).
The author explains how the University of Akron, in an attempt to cut professional costs, built their own line painter for artificial surfaces for under $200. The article details the building of the device as well as the actual lining of the field.

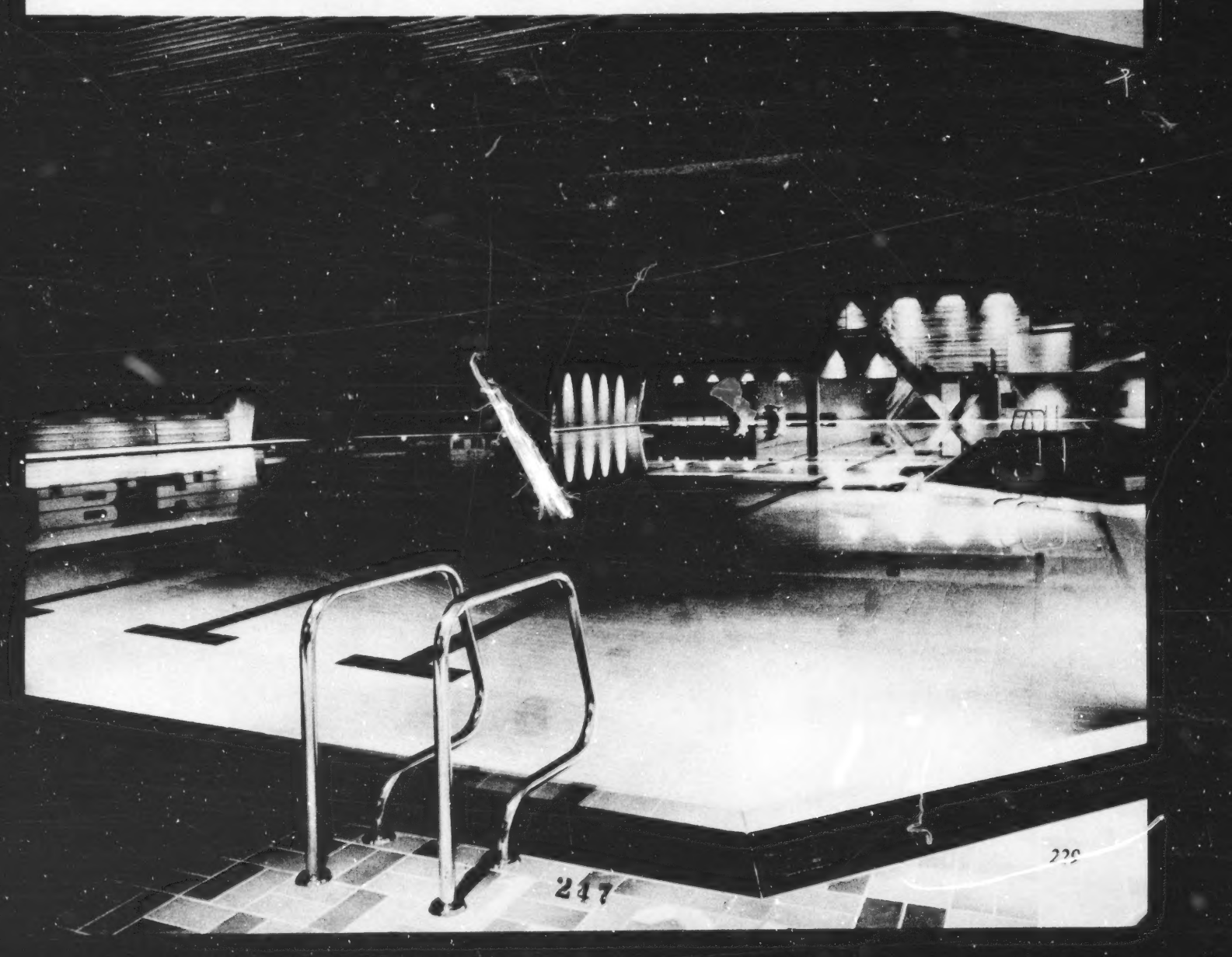
Gibson Health Center, Miami-Dade (Fla.) Community College



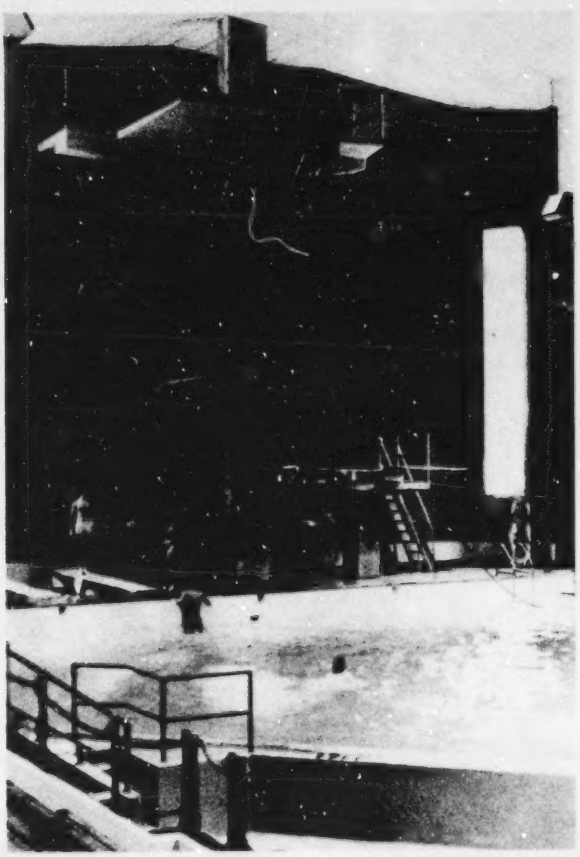
Appendix E

A PORTFOLIO OF SUPPLEMENTARY PHOTOGRAPHS & FIGURES

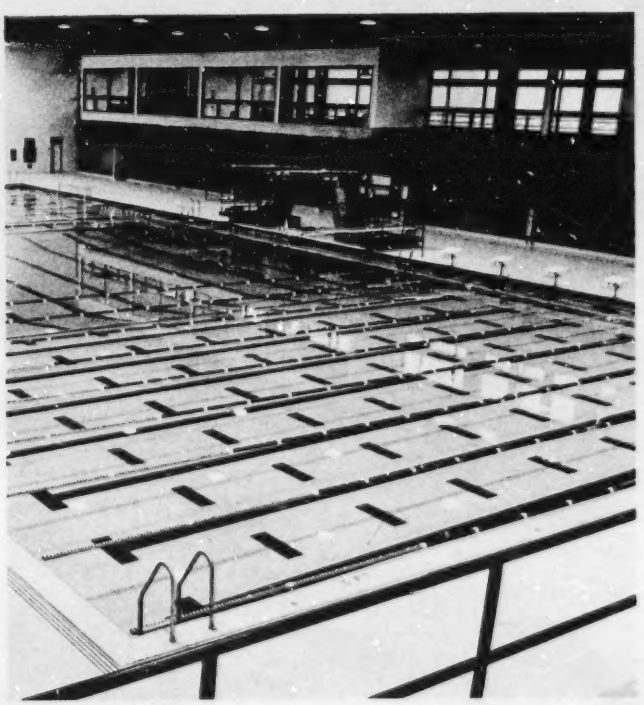
$4.8 million Aquatic Center at the University of British Columbia



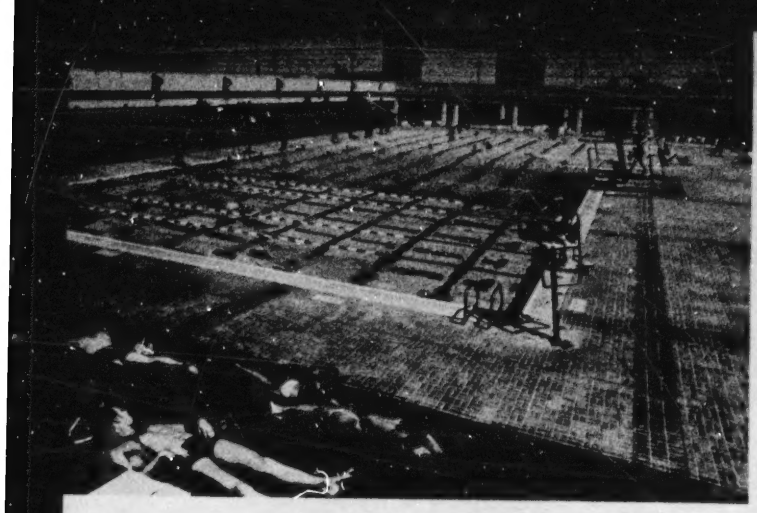
University of Texas pool with two movable bulkheads and diving well

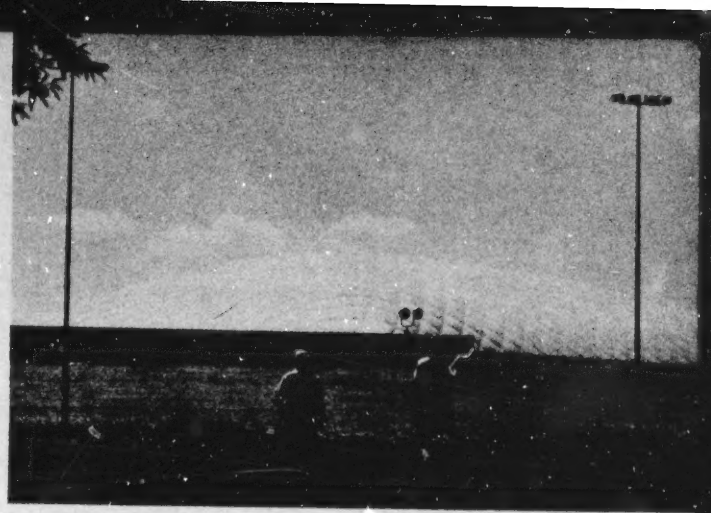


Left: Diving well and tower at Ohio State University.
Below: Olympic-size pool with diving area in the center, cross-pool competitive swimming lanes and longitudinal training lanes.

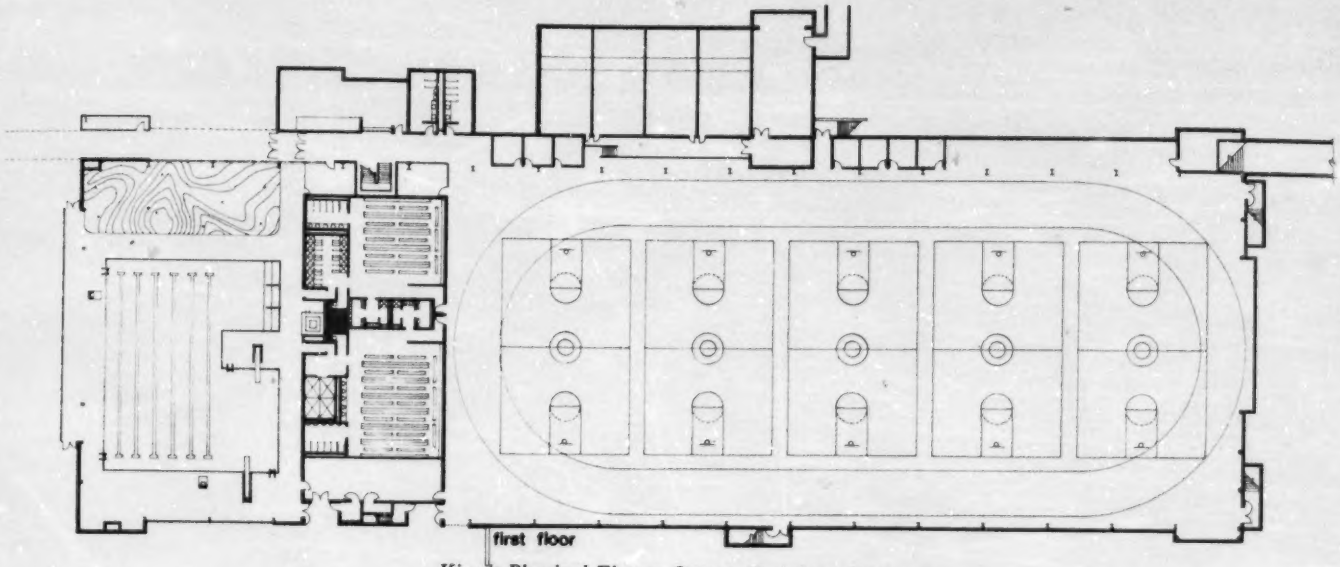


218

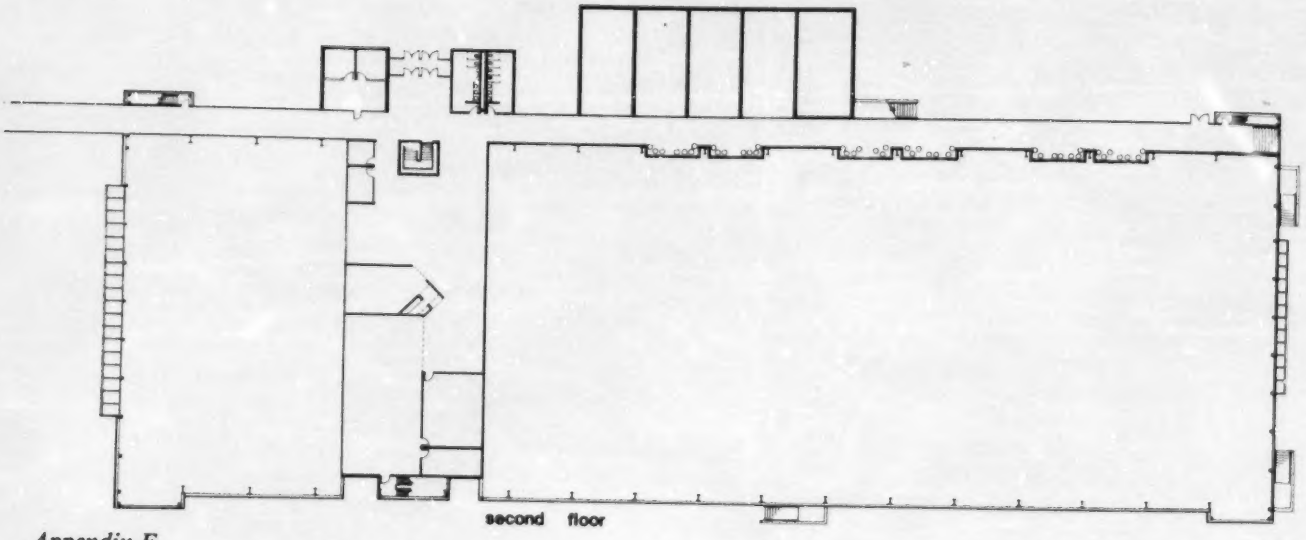


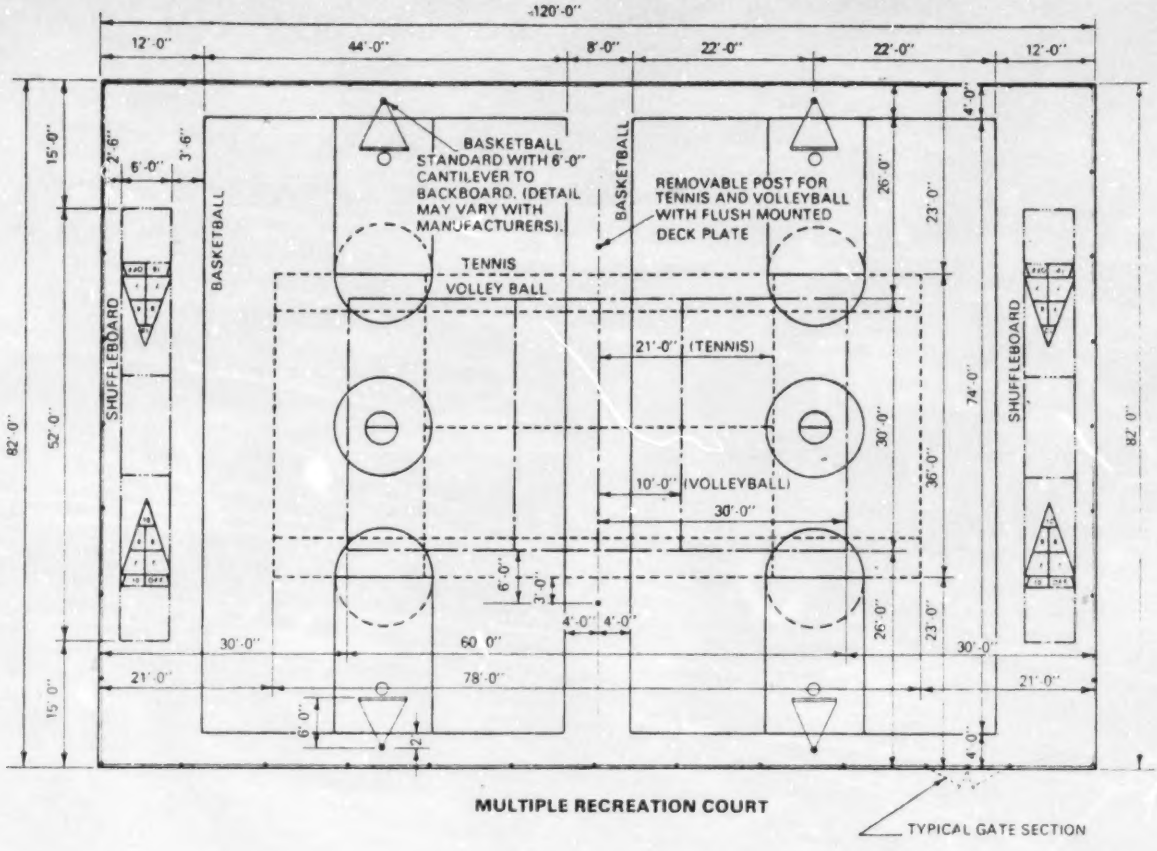


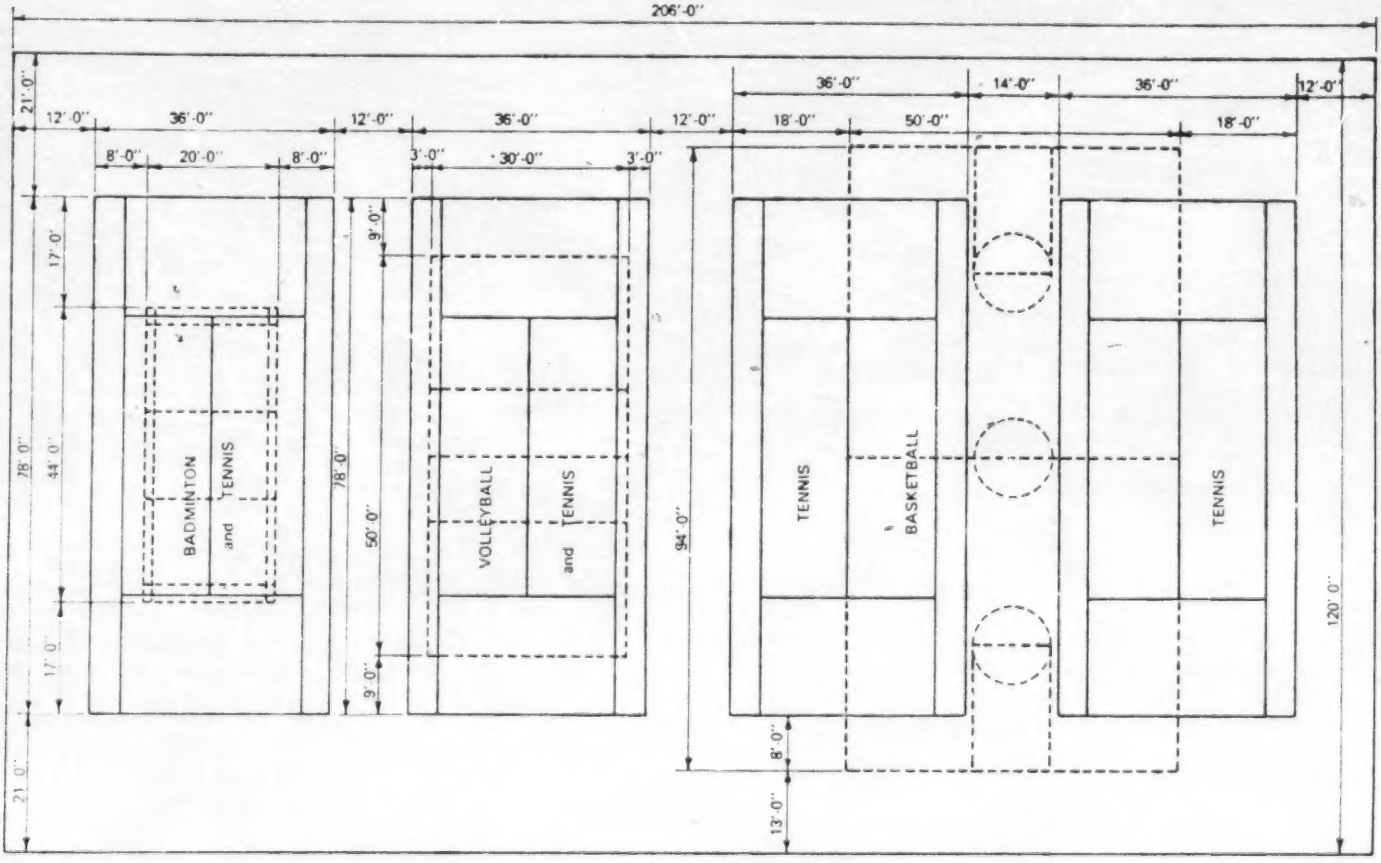
At Texas Tech, the outdoor pool is covered in winter with an air dome



Kiewit Physical Fitness Center, Creighton University




120'-0"
12'-0"
44'-0"
8'-0"
22'-0"
22'-0"
12'-0"
BASKETBALL STANDARD WITH 6'-0" CANTILEVER TO BACKBOARD. (DETAIL MAY VARY WITH MANUFACTURERS).
REMOVABLE POST FOR TENNIS AND VOLLEYBALL WITH FLUSH MOUNTED DECK PLATE
BASKETBALL
BASKETBALL
SHUFFLEBOARD
SHUFFLEBOARD
TENNIS
VOLLEY BALL
21'-0" (TENNIS)
10'-0" (VOLLEYBALL)
30'-0"
82'-0"
52'-0"
15'-0"
74'-0"
60'-0"
78'-0"
30'-0"
21'-0"
MULTIPLE RECREATION COURT
TYPICAL GATE SECTION


206'-0"
36'-0"
14'-0"
36'-0"
12'-0"
18'-0"
50'-0"
18'-0"
8'-0"
20'-0"
8'-0"
3'-0"
30'-0"
3'-0"
BADMINTON
and
TENNIS
VOLLEYBALL
and
TENNIS
TENNIS
BASKETBALL
TENNIS
78'-0"
50'-0"
94'-0"
120'-0"
FOUR TENNIS COURTS WITH ONE BASKETBALL
ONE BADMINTON AND ONE VOLLEYBALL COURT